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# A Synopsis of the Japanese species of Protura

AUTHOR(S):

Imadaté, Gentaro; Yosii, Riozo

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# A Synopsis of the Japanese species of Protura

Gentaro Imadaté and Riozo Yosii

## PREFACE

After the first record of the order Protura from Japan was published in the year 1937 by one of the authors, the knowledge toward the Japanese Proturan fauna has been considerably augmented both in forms and in their distribution. In the present paper, the authors have endeavoured to enumerate the full account of each species in respect to their morphological characters and, then, to consider their position within the world fauna of this group of insects, so far as possible to the authors. Recorded herein are 16 species belonging to 4 different genera and two families. They are:

### Family *Eosentomidae* Berlese

#### Genus *Eosentomon* Berlese

*E. tuxeni* n. sp.

*E. kumei* n. sp.

*E. sakura* n. sp.

*E. pacificum* n. sp.

### Family *Acerentomidae* Silvestri

#### Genus *Acerentulus* Berlese

*A. morikawai* Imadaté et Yosii

*A. montanus* n. sp.

*A. yanasei* n. sp.

*A. tosanus* n. sp.

*A. nitidus* n. sp.

#### Genus *Nipponentomon* n. gen.

*N. nippon* (Yosii)

*N. sawadai* (Imadaté)

*N. dimorphum* n. sp.

*N. uenoi* n. sp.

#### Genus *Acerentomon* Silvestri

*A. yamato* (Imadaté et Yosii)

*A. lubricum* (Imadaté)

*A. takanawanum* (Imadaté)

All the materials used in this report are those which were either collected

by the authors from the forest litter in using Berlese's funnel or sent by various zoologists to them. First of all, Mr. K. Morikawa of Ehime University has favoured them by furnishing rich materials from Shikoku. Further materials were kindly given by Messers. S. Uéno, K. Sawada, T. Yanase, S. Tanaka, K. Mizuta and S. Miyako. During this study the authors were much helped by Prof. S. L. Tuxen for kind instructions and suggestions, as well as by Dr. G. Glance (U.S.A.), Prof. A. X. da Cunha (Portugal), Dr. J. Paclt (Czechoslovakia), Prof. J. Stach (Poland), Dr. K. Strenzke (Germany), Prof. F. Bonet (Mexico), Prof. H. Gisin (Switzerland) and not to the last by Prof. C. Ionesco (Rumania) by giving them many valuable informations. To all of them, the authors must express their hearty thanks. They are also much obliged to Miss. K. Masuda and Mr. G. Amaya for their kind helps.

All the specimens are preserved in the Biological Laboratory, Yoshida College, Kyoto University. Some duplicate specimens are to be found in the collection of Prof. Tuxen, Zoological Museum, Copenhagen.

## FAMILY EOSENTOMIDÆ BERLESE

*Eosentomon tuxeni* n. sp.

(Pl. I, figs. 1-5)

Total length of the body 1,200~1,300  $\mu$  in adults. Integument well chitinized. Head: Labrum somewhat protruded. Head oval, 143  $\mu$  without labrum in length and 94  $\mu$  in width. Pseudoculi ovate, 14  $\mu \times$  9  $\mu$ , bilocular. The median pairs of cephalic setae short being 15  $\mu$  or less.

Thorax: Dorsally, the anterolateral setae (4a) of mesothorax are 12  $\mu$  long. Those of metathorax, however, are only 6  $\mu$  and are not easy to observe. Ventrally, metathorax is provided with 18 small setae, viz. the first row 1 + 1, the second row 4 + 4, the third row 3 + 3. Besides, there are 1 + 1 extra setae near the posterior margin, posterior to the inner pair of the third row.

Front legs: Coxa, trochanter, femur and tibia are provided each with 10, 6, 16 and 19 setae respectively. Foretarsus 87~100  $\mu$ ; claw 17~20  $\mu$ , TR=5.0. The position and the shape of sensillae are shown in fig. 3 a-b. On the dorsal side, setae  $\alpha$  1, 2, 3, 3', 4, 5, 6 and 7 are present. Sensilla t-1 is short and lanceolate apically. t-2 is thinner and a little longer. t-3 is very small and alike to t-1 in shape. Setae  $\beta$  1-9 are seen on the ventral side. On the outer side, setae  $\gamma$  1~5 are observed. Sensilla a and b are subequal in length, c-1 extremely long and setiform, c-2 fairly broad. b, c-1, c-2 and  $\beta$  4 form a transverse row. d and  $\alpha$  5 near to each other. Sensilla e which is generally present near  $\beta$  6,  $\gamma$  3 and  $\gamma$  4 is, notably, quite absent in this species. f-1 is a little longer than f-2. They are needle-like. g is long and clavate as usual. Upon the inner side, setae  $\delta$  1, 2, 3, 3', 4, 4' and 5 are present. Sensillae a' (a'-1) is fairly broad. One more additional sensilla, a'-2, is found near the side of t-1. This remarkable sensilla is very long and distinctly broad. b'-1 is a little longer than b'-2 and located near to each other. c' resembles a'-2 in shape, but a little smaller than the latter. Empodial sensilla subequal to claw in length and with clavated end. (For the nomenclature of each setae refer Tuxen 1956 a)

Middle legs: Length of tarsus 44~46  $\mu$ , claw 12~14  $\mu$ . Tarsus has 17 setae. Most of them, excepting 3 setae, D 1, 2 and 4, are converted to large spines, B 3 on the ventral side is the largest.

Hind legs: Tibia is provided with 12 setae in contrast to middle legs which has 10 setae, 8 of these setae form a ring around the apex and the other 4

setae form a ring at the middle.\* Tarsus has 18 setae, 54~57  $\mu$  in length and its claw 12~15  $\mu$ . The large subapical spines of tarsus are B 4 on ventral side and A 4 on dorsal side (Fig. 4).

Abdomen: The anterior setae 3 of tergites IV-VI is lacking. On tergite VII, the anterior setae 1 and 3 are missing and the accessory setae of posterior row (1-a) are located between 1 and 2, posterior to them. One microchaeta is present lateral to posterior setae 3 on tergite I. On sternite XI of mature junior, only 4 setae are seen as usual.

		T.	S.
Th.	I	4	14
	II	10-12	14
	III	10-12	18
Abd.	I	4-8	4-4
	II-III	12-14	6-4
	IV-VI	10-14	6-10
	VII	8-14	6-10
	VIII	6-9	7
	IX-X	8	4
	XI	8	8
	Telson	11	10

The variation of the chaetotaxy seems to be rare in the present species. Twelve specimens examined do not deviate from the above description excepting 1 ♂ from Ashû, Kyoto which has the anterior setae 3 on tergite IV. All abdominal appendages are two-segmented and each with 5 setae. Male and female genital organs as shown in fig. 5 a-b.

Holotype: 1 ♂, Ashû, Kyoto (20. VIII. 1956, R. Yosii leg.).

Localities: Ashû, Kyoto (2 ♂, 20. VIII. 1956, R. Yosii leg.). Uji, Kyoto (1 mature junior, 24. VI. 1955, R. Yosii leg.). Mt. Yoshino, Nara (1 ♀, 18. V. 1953, K. Sawada leg., 3 ♀, 30. VII, ~6. VIII. 1954, G. Imadaté and C. Tsutsumi leg.). Mt. Kôya, Wakayama (1 ♂, 31. VII. 1954, K. Mizuta and S. Tanaka leg.). Mt. Sara-ga-miné, Ehimé (1 ♂, 2. VIII. 1954, K. Morikawa leg.). Ôno-ga-hara, Ehimé (1 ♂ and 2 ♀, 3. VIII. 1954, K. Morikawa leg.).

\* According to Tuxen (1949), both middle and hind tarsi have the same mode of chaetotaxy. But, so far as the writers have ascertained in the present species, the middle tibia has 7 distal and 3 middle setae, while the hind tibia has 8 distal and 4 middle setae.

Notes: With the absence of the sensilla e on foretarsus and the anterior setae 3 on tergites IV-VII, the species is nearly related to *E. pumilio* Bonet from Mexico, from which it is distinguished by the presence of anterior setae 4-a and 4-b and the absence of anterior setae 1 on tergite VII. The new species is named in dedicating to the prominent entomologist, Prof. S. L. Tuxen, Copenhagen, to whom the writers owe perpetual encouragement.

*Eosentomon kumei* n. sp.

(Text-fig. 1, Pl. II, figs. 6-7)

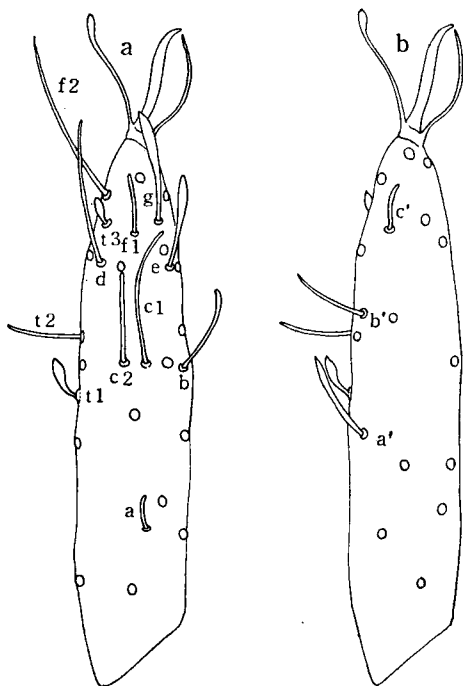
Length of the body  $1,100\ \mu$  in an expanded condition. Integument chitinized.

Head: Labrum a little protruded. Head oval,  $130\ \mu$  without labrum in length and  $90\ \mu$  in width. Pseudoculi ovate and bilocular. The median pairs of cephalic setae short.

Thorax: Dorsally, the anterolateral setae (4a) of metathorax are not seen. Ventrally, metathorax is provided with 18 setae just like *E. tuxeni* n. sp.

Apodemes of thoracal segments are not well developed, compared with the next species: *E. sakura* n. sp.

Front legs: Coxa, trochanter, femur and tibia are provided each with 9, 4, 16 and 18 small setae. Tarsus is  $83\sim 86\ \mu$ , claw  $14\sim 15\ \mu$ ,  $TR=5.3\sim 5.7$ . The position and the shape of its sensillae are shown in text-fig. 1 a-b. Dorsally, setae  $\alpha$  1, 2, 3, 3', 4, 5, 6 and 7 are present. Sensilla t-1 is short and distinctly lanceolate. t-2 is thinner and a little longer. t-3 is very small and alike to t-1 in shape. Ventrally, setae  $\beta$  1-9 are present. Exteriorly, setae  $\gamma$  1-5 are observed. Blunt sensilla a is very short compared with that of *E. tuxeni* and, therefore, not easily to be seen. b and c-2 are subequal in length. A needle-shaped sensilla c-1 extremely long and surpasses with its apex the base of  $\gamma$  4. d and  $\alpha$  5 near to each other. Club-



Text-fig. 1.

a-b: *Eosentomon kumei* n. sp.

Foretarsus in exterior and interior view.

shaped sensilla e is located between  $\beta 6$  and  $\gamma 4$ . Blunt sensilla f-1 is short, but a little longer than a. f-2 is the longest and setiform. g is a little longer than e and clavate as usual. Interiorly, setae  $\delta 1, 2, 3, 3', 4, 4', 5$  and 6 are present. Sensilla a' (a'-1) is located posterior to t-1 and fairly broad. b' (b'-1) has needle-like apex, a little broader and is located near to  $\delta 4'$  and  $\alpha 4$ . a'-2 and b'-2 are missing. c' is very small and a little clavate. Empodial sensilla subequal to claw in length and with clavated end.

Middle legs: Length of tarsus  $37 \mu$ , claw  $10 \mu$ . Ventrally, subapical spine (B3) is the largest.

Hind legs: Tibia is provided with 10 setae, 7 distal and 3 middle ones, as usual. Length of tarsus  $49 \mu$ , claw  $11 \mu$ . Tarsus has 18 setae. They are heavy and large excepting thinner and shorter setae: D 1-5. A3 and A4 of the dorsal setae are strikingly large among them. Ventral setae B3 and B4 are thinner than dorsal ones.

Abdomen: The anterior setae 3 are lacking on tergites IV-V. On tergites VI-VII the anterior setae 1, 2 and 3 are missing. The accessory setae 1a of posterior row on tergite VII are very small and located near to the posterior setae 2, on the same niveau with the principal setae. Other accessory setae 2a are located posterior to them. One microchaeta is present lateral to posterior setae 3 on tergite I. No variation of the chaetotaxy was found among 5 specimens investigated.

		T.	S
Th.	I	4	14
	II	10-12	14
	III	8-12	18
Abd.	I	4-8	4-4
	II-III	12-14	6-4
	IV-V	10-14	6-10
	VI-VII	6-14	6-10
	VIII	6-9	7
	IX-X	8	4
	XI	8	8
	Telson	11	10

All abdominal appendages are two-segmented and each with 5 setae. Male and female genital organs are alike to that of *E. tuxeni*. Female one as shown

in fig. 7.

Holotype: 1 ♀, Mt. Yoshino, Nara (30. VII. 1954, G. Imadaté leg.).

Localities: Ashû, Kyoto (1 ♂ and 1 mature junior, 20. VIII. 1956, R. Ycsii leg.). Usa, Kôchi (1 ♂, 11. VII. 1954, K. Morikawa leg.).

Notes: This new species *E. kumei*, which is named in honour of Prof. N. Kume, Kyoto University, is conspicuous in having rather exceptional chaetotaxy of abdominal tergites and fcre tarsal sensillae. It is near to *E. yosemitense* Ewing and the group of *E. wygodzinskyi* Bonet (*E. wygodzinskyi* Bonet, *E. venezuelense* Glance, *E. westraliense* Womersley, *E. dawsoni* Condé, *E. pacificum* n. sp. and *E. sakura* n. sp.), but may be distinguished from the former by having no anterior setae 3 on tergite V and 1, 2, 3 on tergite VI. From the latter it is to be distinguished by the absence of the anterior setae 3 on tergite IV as well as by the presence of the anterior setae 4 on tergite VII.

***Eosentomon sakura* n. sp.**

(Pl. II, figs. 8-10)

Length of the body in adults  $1,500\ \mu$ , in expanded condition. Integument well chitinized.

Head: Labrum poorly developed. Head oval,  $150\ \mu$  in length in lateral view without labrum. Breadth  $106\ \mu$ . Pseudoculi small,  $11\sim12\ \mu \times 5\sim6\ \mu$ , oval and bilocular. The median pairs of cephalic setae short.

Thorax: Dorsally, the anterolateral setae (4a) of mesothorax are not seen. Ventrally, mesothorax is provided with 18 setae just like *E. tuxeni* n. sp. Apodemes of thoracal segments are well developed and distinctly observed. The ventral median apodeme of mesothorax has a small ring well sklerotized at the posterior edge.

Front legs: Coxa, trochanter, femur and tibia are provided each with 9, 4, 16 and 18 small setae. Tarsus is  $85\sim100\ \mu$ , claw  $17\sim20\ \mu$ ,  $TR=5.0$ . The position and the shape of its sensillae are shown in fig. 9 a-b. Dorsally, setae  $\alpha$  1, 2, 3, 3', 4, 5, 6, 7 are present. Sensilla t-1 is short and distinctly lanceolate. t-2 is thinner and a little longer than t-1 as usual. t-3 is small and alike to t-1 in shape. Ventral setae  $\beta$  1-9 are present. One more extra seta is located between  $\beta$  6 and  $\beta$  7. Exteriorly, setae  $\gamma$  1-5 are observed. Sensilla a is a little shorter than b. c-1 extremely long, setiform and surpasses with its apex the base of  $\gamma$  4. d is a little detached from  $\alpha$  5 and near to  $\gamma$  3. e is a little longer, clavate apically and located pos-



terior to  $\gamma$  4. f-1 and d are subequal in length and a little longer than b. f-2 is extremely long. g is a little longer and alike to e in shape. Interiorly, one extra sensilla-like seta (x in fig. 9) which is present between  $\alpha$  4 and  $\gamma$  4 is observed beside the usual setae  $\delta$  1, 2, 3, 3', 4, 4', 5 and 6. Such extra seta or sensilla was already drawn in Tuxen's figure of *E. mexicanum* Silvestri (1956a; p. 723, fig. 7), although he did not nominated it. a' is present near to t-1 and fairly broad. b' is thinner and a little longer. c' is short and clavate, but larger than that of *E. kumei*. a'-2 and b'-2 are not seen. Empodial sensilla is a little shorter than the claw.

Middle legs: Length of tarsus  $50\mu$ , claw  $15\mu$ . Ventral spine (B3) is the largest.

Hind legs: Tibia is provided with 10 setae, 7 distal and 3 middle ones, as usual. Length of tarsus  $60\mu$ , claw  $16\mu$ . The largest spine on tarsus is A 4 of the dorsal group.

Abdomen: The anterior setae 1, 2 and 3 are lacking on tergites V-VI. On tergite VII, the anterior setae 1, 2, 3 and 4 are missing and the accessory setae (1a) of the posterior row are very small and located near to the posterior setae 2, on the same niveau with the principal setae. Another accessory setae 2a are located a little posterior to them. One microchaeta is present lateral to posterior setae on tergite I. No variation of the chaetotaxy was observed among 20 specimens at hand.

		T.	S.
Th.	I	4	14
	II	10-12	14
	III	8-12	18
Abd.	I	4-8	4-4
	II-III	12-14	6-4
	IV	12-14	6-10
	V-VI	6-14	6-10
	VII	4-14	6-10
	VIII	6-9	7
	IX-X	8	4
	XI	8	8
	Telson	11	10

All abdominal appendages are two-segmented and each with 5 setae. Female

genital organ is well chitinized as shown in fig. 10.

Holotype: 1 ♀, Mt. Yoshino, Nara (30, VII, 1954, G. Imadaté leg.).

Localities: Mt. Shizu-ga-také, Shiga (1 ♂, 21. XII. 1955, G. Imadaté leg.). Mt. Daimonji, Kyoto (1 ♀, 24. VI. 1954, S. Uéno leg.). Uji, Kyoto (1 ♂ and 2 ♀, 24. IV, ~4. V. 1955, R. Yosii leg.). Nara, Nara (1 ♀, 4. VII. 1954, G. Imadaté leg.). Mt. Yoshino, Nara (1 ♂, 18. V. 1953, K. Sawada leg. 1 ♀ and 1 ♂, 30. VII, ~5. VIII. 1954, G. Imadaté leg.). Nachi, Wakayama (1 ♀, 28. III. 1953, K. Sawada leg.). Shirahama, Wakayama (3 ♂, 3 ♀, 2 m.j., 1 larve I, 9. VIII. 1958, G. Imadaté leg.). Mt. Sugitáté, Ehimé (1 ♂, 17. IX. 1954, K. Morikawa leg.). Waku-ga-fuchi, Ehimé (4 ♂ and 2 ♀, 3. I. 1954 K. Morikawa leg.). Shiroyama, Ehimé (1 ♀, 11. X. 1955, K. Morikawa leg.). Omogô, Ehimé (1 ♂ and 1 ♀, 3. XII. 1953, K. Morikawa leg.). Usa, Kôchi. (2 ♂ and 1 ♀, 14. 1954, K. Morikawa leg.).

Notes: With the diminution of the anterior setae on tergites V-VII, the present new species is near to *E. wygodzinskyi* Bonet, *E. venezuelense* Glance, *E. westraliense* Womersley, and *E. dawsoni* Condé. But it might be possibly distinguished by the foretarsal sensillae from all of them.

***Eosentomon pacificum* n. sp.**

(Pl. II, figs. 11-13)

Total length of the body  $930\mu$  in an adult specimen. Integument well chitinized and pigmented all over the body. Apodemes and tentorium well developed.

Head: Elongated. Labrum slightly protruded. Length  $140\mu$  in dorsal view without labrum, breadth  $88\mu$ . Pseudoculi small,  $8\mu$  long. The median pairs of cephalic setae stout, its length ca.  $17\mu$ .

Thorax: Dorsally, the anterolateral setae (4a) of metathorax are distinctly smaller than those of mesothorax and not easy to observe. Ventrally, metathorax is provided with 18 setae just like *E. tuxeni* n. sp. Apodemes of thoracal segments are all well developed.

Front legs: Tarsus  $114\mu$ , claw  $21\mu$ ,  $TR=5.4$ . The position and the shape of its sensillae are as shown in fig. 12 a-b. Dorsally, setae  $\alpha$  1, 2, 3, 3', 4, 5, 6 and 7 are present. Sensilla t-1 is short and distinctly lanceolate. t-2 is thinner and longer than t-1. t-3 is very small and is not easy to observe. Ventrally, setae  $\beta$  1-9 are present. Exteriorly, setae  $\gamma$  1-5 are observed. Sensilla a is very small and alike to that of *E. boneti* Tuxen (cf. Tuxen (1956 a) p. 721 fig. 1). b and c-2 are subequal in length, c-1 extremely long and setiform.

Needle-like sensilla d is shorter than c-1. f-1 is remarkably thin and short. f-2 is a little longer than c-1 and setiform. e and g are clavated. Interiorly, setae  $\delta$  1, 2, 3, 3', 4, 4' and 5 are present. a' is long, clavate and alike to e and g. b'-1 is longer than b'-2. c' is broad. One extra sensilla-like seta (X in fig. 12) is fairly broad and is present between  $\alpha$  4 and  $\delta$  4. Such extra sensilla or seta is hitherto observed only in *E. mexicanum* Silvestri and *E. sakura* n. sp. a'-2 is absent. Empodial sensilla is a little shorter than the claw.

Middle legs: Length of tarsus  $51\mu$ , claw  $14\mu$ . Ventral spine (B3) is the largest.

Hind legs: Length of tarsus  $68\mu$ , claw  $15\mu$ . A 3 and A 4 are strikingly large among the dorsal setae.

Abdomen: All principal setae of abdomen are longer than that of the other Japanese species of the genus, viz. the posterior principal setae of the other Japanese species are  $20\sim 25\mu$  in length, while those of *E. pacificum* are  $30\sim 40\mu$  in length. The anterior setae 2 and 3 on tergite V as well as 1, 2 and 3 of tergite VI are lacking. On tergite VII, the anterior setae 1, 2, 3 and 4 are missing and the accessory setae of posterior row 1-a are located between 1 and 2 and posterior to them. The posterior setae 2 of tergites II-VII are located a little anterior to other principal setae.

		T.	S.
Th.	I	4	14
	II	10-12	14
	III	10-12	18
Abd.	I	4-8	4-4
	II-III	12-14	6-4
	IV	12-14	6-10
	V	8-14	6-10
	VI	6-14	6-10
	VII	4-14	6-10
	VIII	6-9	7
	IX-X	8	4
	XI	8	8
	Telson	11	10

All abdominal appendages are two-segmented and with 5 setae. Female genital organ is as shown in fig. 13.

Holotype: 1 ♀, Kashima Island, Ehimé (15, VII, 1955, K. Morikawa leg.).

Notes: The present new species *E. pacificum* is near to *E. sakura* n. sp. and its allied species by the absence of the anterior setae 1, 2, 3 and 4 on tergite VII, 1, 2 and 3 on Tergite VI and by the presence of the sensilla or seta (shown by X in fig. 12-b) on the interior face of foretarsus. But it may be distinguished from those by the anterior setae 1 on tergite V, the shape of sensillae a and a' on foretarsus, the stouter and longer setae on the body and lastly by the position of the posterior accessory setae 1-a on tergite VII.

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The majority of the known species belonging to *Eosentomon* have some features of the abdominal chaetotaxy in common: Tergite I has always 2 pairs of anterior and 4 pairs of posterior setae. Tergites II-VII have 6 pairs of anterior and 7 pairs of posterior setae. The posterior setae do not show any specific differences, although the accessory setae (1-a) may be smaller and nearer to the principal setae 2 in some species (cf. *E. wygodzinskyi* Bonet). Anterior row of setae exhibits the greatest variability in specific character. Six pairs of setae on each tergite are diminishing according to the species and no case with additional number of setae is yet observed. Tergites VIII-XII seem to be uniform in all the known species with respect to their chaetotaxy. Sternites I-VII are also not variable in their setae, while the chaetotaxy of sternite VIII shows slight differences, viz. whether it has one median posterior seta (*E. transitorium* Berlese) or a pair of extra anterior setae (*E. mexicanum* Silvestri). Exceptionally, there exists one species which has both of them (*E. swani* Womersley). Sternites IX and X have either 2 pairs or 3 pairs of setae, but they have no significant meaning. The most remarkable and significant modification of the abdominal chaetotaxy is found in the anterior setae of tergites II-VII. In the genus *Eosentomon*, the basic number of each row of setae seems to be in 6 pairs, which may be modified according to species and groups. When the diminution occurs, it is the third pair (setae 3) which is most sensitive to be missing. Then, follows the first pair (1) and the second one (2). The fourth pair (4) disappears rarely, the fifth one the rarest and to the last. When the diminution occurs and when tergites V, VI and VII are receiving diminution simultaneously, setae of tergite VII are equally or more strongly modified than those of the precedent tergites. In the following table, chaetotaxic characters of all

the known species of the world are summarized from such a point of view, as to show the phylogenetic groups of each species.

Table I

Group	Species	Terg. II	III	IV	V	VI	VII	Distribution
A.	<i>E. atlanticum</i> *	—	—	—	—	—	—	Europe
B.	<i>E. spinosum</i> *	—	—	—	—	—	1.3	—
	<i>E. condéi</i>	—	—	—	—	—	1.3	—
	<i>E. delicatum</i>	—	—	—	—	—	1.2.3	—
	<i>E. transitorium</i>	—	—	—	—	—	1.3	Europe and Africa
	<i>E. satigerum</i> *	—	—	—	—	—	1.3	Africa
	<i>E. pusillum</i>	—	—	—	—	—	1.3	U.S.A. (Atlantic)
C.	<i>E. christensoni</i>	—	—	—	—	3	1.2.3	—
D1	<i>E. pallidum</i>	—	—	—	3	3	1.2.3	—
	<i>E. wheeleri</i>	—	—	—	3	3	1.3	—
	<i>E. vermiforme</i>	—	—	—	3	3	1.3	—
	<i>E. rostratum</i> *	—	—	—	3	3	1.3	—
	<i>E. carolae</i> **	—	—	—	(3)	(3)	(1.3)	Europe
	<i>E. denisi</i> **	—	—	—	(3)	(3)	(1.3)	—
	<i>E. simile</i> **	—	—	—	(3)	(3)	(1.3)	Africa
	<i>E. coqueti</i> *	—	—	—	3	3	1.2.3	—
	<i>E. machadoi</i>	—	—	—	3	3	1.2.3	—
	<i>E. cf. machadoi</i>	—	—	—	2.3	1.2.3	1.2.3	—
	<i>E. perreti</i>	—	—	—	1.2.3	1.2.3	1.2.3	—
	<i>E. swani</i> *	—	—	—	3	3	1.2.3	Australia
D2	<i>E. westraliense</i> *	—	—	—	1.2.3	1.2.3	1.2.3.4	—
	<i>E. dawsoni</i> *	—	—	—	1.2.3	1.2.3	1.2.3.4	New Zealand
	<i>E. sakura</i>	—	—	—	1.2.3	1.2.3	1.2.3.4	Japan
	<i>E. pacificum</i>	—	—	—	2.3	1.2.3	1.2.3.4	—
	<i>E. wygodzinskyi</i>	—	—	—	1.2.3	1.2.3	1.2.3.4	South America
	<i>E. venezuelense</i>	—	—	—	1.2.3	1.2.3	1.2.3.4	—
E2	<i>E. yosemitense</i>	—	—	2	2.3	2.3	2.3.4	U.S.A (Pacific)
E1	<i>E. kumzi</i>	—	—	3	3	1.2.3	1.2.3	Japan
	<i>E. tuxeni</i>	—	—	3	3	3	1.3	—
	<i>E. pumilio</i>	—	—	3	3	3	2.3	Mexico
F2	<i>E. depilatum</i>	—	3	2.3	2.3	1.2.3.4.4a	1.2.3.4.4a	—
	<i>E. destitutum</i>	—	3	3	3	3.4	3.4	—
F1	<i>E. maya</i>	—	3	3	3	3	1.2.3	—
	<i>E. boneti</i>	—	3	3	3	3	1.3	—
	<i>E. saharensense</i>	—	3	3	3	3	1.3	Africa
	<i>E. mexicanum</i>	—	3	3	3	3	3	Mexico
	<i>E. lentum</i>	—	3	3	3	3	3	—
	<i>E. pelaezi</i>	—	3	3	3	3	3	—
	<i>E. beltrani</i>	—	3	3	3	3	3	—
	<i>E. reclusa</i>	—	3	3	3	3	3	—
G	<i>E. bolivari</i>	3	3	3	3	3	3	—

\* Dr. S. L. Tuxen has kindly informed us (personal communication) some of the results of his studies to accomplish the present table, for which we express our sincere thanks.

\*\* Several species are not known to us from the literature; they are omitted in the table. *E. carolae*, *denisi* and *simile* are not exactly known to interpret missing setae.

Table I shows that the genus *Eosentomon* may be divided into 10 groups, according to the chaetotaxy. They may be summarized as follows:

A-Group: All six pairs of the anterior setae present on tergites II-VII.

B-Group: All six pairs of them present on tergites II-VI.

C-Group: All six pairs of them present on tergites II-V.

D-Group: All six pairs of them present on tergites II-IV.

D1-Group: The fourth pair present on tergite VII.

D2-Group: The fourth pair absent on tergite VII.

E-Group: All six pairs of them present on tergites II-III.

E1-Group: The fourth pair present on tergite VII.

E2-Group: The fourth pair absent on tergite VII.

F-Group: All six pairs of them present on tergite II.

F1-Group: The fourth pair present on tergite VII.

F2-Group: The fourth pair absent on tergite VII.

G-Group: The third pair always absent on tergites II-VII.

An attempt is made to show these groups of *Eosentomon* according to their geographical distribution in a diagram as Table II, so that we may get the clear idea about the characteristics of each region according to groups they have. The results may be expressed as follows:

Table II

	A	B	C	D1	D2	E2	E1	F2	F1	G
Europe	●	●	—	●						
Africa		●	—	●	—	—	—	—	—	●
U.S.A. (Atlantic)		●	—	●						
(Pacific)						●				
Mexico							●	—	—	—
South America					●					
Oceania				●	—					
Japan					●	—	●			

*Europe*: A, B and D1 are coexisting. The most prevalent forms of them are of B-Group.

*North America*: B, C, D1 and E2 are known. The former three are reported from the Atlantic side of the continent with prevalent D1 group; thus they show its formal relationship to the European

continent. E2 is known from the Pacific coast only, showing relations to Japan and Oceania.

*Africa*: B, D1 and F1 are represented. Prevalent species belong to D1 alike to those of North America and Europe. But D1-Group of Africa has a peculiarity of its own and might be referable to those of Oceania (*E. perreti*). That F1 is also present in this territory, which is concordant only with that of Mexico, shows that in the Africa influences of various elements are mingled.

*Middle America*: Mexican fauna is very peculiar in having E1, F1 and G. The prevalent group is F1. It is seemingly a very characteristic region.

*South America*: Only D2-Group is known.

*Oceania*: Both D1 and D2 are known. Some relations to Africa on one side and to South America and Japan on the other.

*Japan*: D2 and E1 are known. Notwithstanding its geographical position in the northern hemisphere, there seems to exist a circum Pacific element in common with South America, Mexico and Oceania.\*

As for the phylogenetic interpretation of the chaetotaxic groups of *Eosentomon*, the genus is supposed to be split in three categories.

1. European Element:

Basic groups are B and D1, accompanied by A and C. B is predominant in Europe and D1 in Atlantic coast of North America. Some of the D1-Group show relations to D2 and others are to E1 and F1.

2. Pacific Element:

With the basic group of D2, they are clearly isolated from other two groups. But, *E. perreti* (D1), *yesomitense* (E2), *depilatum* (F2) and *kumei* (E1) may be regarded to show some relations to each others. Distribution: South America, Oceania and Japan.

3. Caribbean Element:

Basic group is F1, accompanied by F2 and G. It is distributed presumably in Mexico.

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\* That all species of *Eosentomon* in Japan are of circum Pacific element is peculiar in the general trend of faunistic knowledge of Pterygotes, but are not very surprising among Apterygotes. In the Collembola, the genus *Orchesella* occurs in Europe and North America, ranging to Northern Africa and near East, but is absent from the other parts of the world. *Metriocampa* of Campodeidae is reported from South Africa, South America, Oceania and Japan.

## FAMILY ACERENTOMIDÆ SILVESTRI

*Acerentulus morikawai* Imadaté et Yosii

(Pl. III, figs. 14-18)

*A. morikawai* Imadaté et Yosii, 1956, Ins. Mats., 20 (1/2): 14-16.

Total length of the body 1,200~1,000  $\mu$  in fully expanded adults. Integument well chitinized and yellowish pigmented all over the body. Apodemes and tentorium well developed.

Head: Labrum slightly protruded. Length 115~126  $\mu$  in dorsal view, breadth 77~82  $\mu$ . Pseudoculi 8  $\mu$  long, ovate and bilocular as usual. "Filamento di Sostegno" of maxilla unbranched and surpasses the maxillary branch of tentorium as that of *A. confinis exiguus* Condé. Median pairs of cephalic setae stout and long, being about 25  $\mu$ .

Thorax: Dorsal side of meso- and metathorax are provided each with 4 anterior, 2 middle and 14 posterior setae. The anterior setae 1 small and thin, 3 stout and long, while 2 and 4 are quite absent. Ventral side of these segments are provided with 7 anterior, 2 middle and 4 posterior setae. The inner pair of anterior setae is small and thin.

Front legs: Tarsus 96~110  $\mu$ , claw 24~28  $\mu$ , TR=3.7.—4.0. The position and the shape of its sensillae are as in fig. 16 a-b. Dorsally, setae  $\alpha$  1~7 are present. Sensilla t-1 is short and apically clavate. t-2 is longer than t-1 and setiform. t-3 is small and lanceolate. Ventrally, setae  $\beta$  1~7 are present. Exteriorly, setae  $\gamma$  1~5 are observed. Sensilla a is a little broad. b is broader than a, elongate and surpasses the base of  $\beta$  4 with its apex. c and a are equal in length and a little shorter than b. e is shorter than c and d. f extremely long, surpassing the tarsus. g short. Interiorly, setae  $\delta$  1~6 are present. Sensilla a' is seen between t-1 and t-2, distinctly broad and long. b' is missing. c' is a little broad. S-shaped seta subequal to claw in length. Claw without inner tooth.

Middle and Hind legs: Length of tarsus 48-56  $\mu$ , claw 14-16  $\mu$ . One prominent inner tooth is present. Middle tarsus is a little shorter than the hind one.

Abdomen: The anterior setae 3 and 4 on tergites II-V, 3 on tergite VI,\* 1 and 3 on tergite VII are absent. The posterior setae 3 are located between 2-a and 4, i.e. anterior to the other setae of the posterior row upon tergites

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\* One male from Mt. Takanawa has no anterior setae 3 and 4 on tergite VI.



II-VI. The accessory setae 1-a of posterior row are very small and near to 1 on tergites II-VII. On tergite VIII, the central seta is absent, but 4 anterior, 8 middle and 6 posterior setae are present. Ventrally, only two posterior setae are observed on sternite I. Sternites II-III are all provided with 5 posterior setae. The pectinated comb of tergite VIII consists of 10~12 small teeth of equal size. Abdominal appendages II-III are unisegmented.

		T.	P.	S.
Th.	I	4		4-2-6
	II-III	4-2-14		7-2-4
Abd.	I	4-8	2	3-2
	II-III	4-12	3	3-5
	IV-V	4-12	3	3-8
	VI	6-12	3	3-8
	VII	4-14	2	3-8
	VIII	4-8-6	2	4
	IX	10	2	4
	X	10	1	4
	XI	4	1	6
	Telson	9		6

Specimens examined: 1 ♂ (Holotype), Waku-ga-fuchi, Ehimé (3. XI. 1954, K. Morikawa leg.). 2 ♂, Omogô, Ehimé (23. XI. 1954, K. Morikawa leg.). 1 ♂ and 1 m. J., Shiroyama, Ehimé (11. X. 1955, K. Morikawa leg.). 1 ♀ and 2 ♂, Mt. Takanawa, Ehimé (23. X. 1954, K. Morikawa and T. Yano leg.). 1 ♀, Tsukuho, Fukuoka (5. I. 1957, S. Miyako and G. Imadaté leg.).

Notes: With the position of the sensilla d on foretarsus, the species is nearly related to *A. berberus* Condé, *A. caldarius* Condé, *A. populeus* Cunha and *A. travassosi* Silvestri, but may be distinguished from those by the abdominal chaetotaxy and the pectinated comb of tergite VIII.

***Acerentulus montanus* n. sp.**

(Pl. III, figs. 19-21)

*A. morikawai* Imadaté et Yosii (Partim), Ins. Mats., 20 (1/2): 14-16, 1956.  
Total length of the body 1,120  $\mu$  in a completely expanded female. Integu-

ment well chitinized and yellowish pigmented all over the body. Apodemes and tentorium well developed.

Head: Labrum slightly protruded. Length  $130\ \mu$  in lateral view, breadth  $80\ \mu$ . Pseudoculi ovate and bilocular,  $10\ \mu \times 8\ \mu$ . "Filamento di Sostegno" of maxilla unbranched and surpasses the maxillary branch of tentorium like that of *A. morikawai* Imadaté et Yosii, but a little shorter than the cited one. Median pairs of cephalic setae stout and long, being  $26\sim 28\ \mu$ .

Thorax: Dorsal side of meso- and metathorax are provided each with 4 anterior, 2 middle and 14 posterior setae. The anterior setae 2 and 4 quite absent. Ventral side of these segments have 5 anterior, 2 middle and 4 posterior setae. The small inner pair of anterior setae of *A. morikawai* is not seen.

Front legs: Tarsus  $94\sim 106\ \mu$ , claw  $28\sim 32\ \mu$ ,  $TR \div 3.3$ . The position and the shape of its sensillae are as fig. 20 a-b. Setae  $\alpha, \beta, \gamma, \delta$  are not different from that of *A. morikawai*. t-1 is short and clavate apically. t-2 is setiform and longer than t-1. t-3 is small and lanceolate. Exteriorly, sensilla a and e are equal in length. b is broad and long. c and d are thin and a little longer than b. c, d and f are equal in length. g is short and a little broad apically. Interiorly, a' is distinctly broad and surpasses the base of t-2 with its apex. b' is missing. c' is not broad. S-shaped seta subequal to claw in length, claw without inner tooth.

Middle and Hind legs: Length of tarsus  $56\sim 60\ \mu$ , claw  $18\sim 20\ \mu$  and a prominent inner tooth is present. Middle tarsus is a little shorter than hind one.

Abdomen: In three specimens examined, the anterior setae 3 and 4 on tergites II-V, 3 on tergite VI are absent. On tergite VII, five anterior setae are observed in one female from Mt. Sara-ga-miné, which has the anterior seta 1 on one side only, but four anterior setae, 2 and 4, are observed in all other examples. The posterior setae 3 are located between 2-a and 4 and anterior to the other posterior setae on tergites II-VI. On tergite VIII, the central seta is quite absent, while 4 anterior, 8 middle and 6 posterior setae are present. Ventrally, only two posterior setae are seen on sternite I.

The pectinated comb of tergite VIII consists of  $8\sim 10$  small teeth and the inner posterior margin somewhat protruded as shown in fig. 21. Abdominal appendages II-III are uni-segmented.

		T.	P.	S.
Th.	I	4		4-2-6
	II-III	4-2-14		5-2-4
Abd.	I	4-8	2	3-2
	II-III	4-12	3	3-5
	IV-V	4-12	3	3-8
	VI	6-12	3	3-8
	VII	4-14	2	3-8
	VIII	4-8-6	2	4
	IX	10	2	4
	X	10	1	4
	XI	4	1	6
	Telson	9		6

Holotype: 1 ♀, Mt. Sara-ga-miné, Ehimé (30. X. 1954, K. Morikawa and K. Ochi leg.).

Localities: Mt. Sara-ga-miné, Ehimé (2 ♂ and 2 ♀, 30. X. 1954, K. Morikawa and K. Ochi leg.). Ôno-ga-hara, Ehimé (1 ex., 3. VIII. 1954, K. Morikawa leg.).

Notes: The present species is closely related to *A. morikawai* Imadaté et Yosii in the position of the sensillae on foretarsus and the abdominal chaetotaxy. It is, however, distinguished by the absence of the inner pair of setae on the ventral side of meso- and metathorax. The shape of the pectinated comb on tergite VIII, the ratio of TR and the relative length of the sensillae on foretarsus are also different.

*Acerentulus yanasei* n. sp.

(Pl. III. figs. 22-25)

Body length 960~1,000  $\mu$  in expanded adults. Integument well chitinized and yellowish pigmented. Apodemes and tentorium well developed.

Head: Labrum poorly developed. Head oval, 90~100  $\mu$  in dorsal view, breadth 62~68  $\mu$ . Pseudoculi small being 6  $\mu$  in length. The median pairs of cephalic setae short and 20  $\mu$  or less in length. "Filamento di Sostegno" of maxilla unbranched and surpasses the maxillary branch of tentorium.

Thorax: The ventral side of meso- and metathorax are provided each with 11 setae, 5 anterior, 2 middle and 4 posterior ones. The inner pair of the anterior setae of *A. morikawai* is missing.

Front legs: Tarsus  $66\sim 80\ \mu$ , claw  $18\sim 23\ \mu$ ,  $TR=3.5$ . The position and the shape of sensillae are shown in fig. 24 a-b. Setae  $\alpha$  1~7,  $\beta$  1~7,  $\gamma$  1~5 and  $\delta$  1~6 are present. Dorsal sensilla t-1 is short and clavate apically. t-2 is longer than t-1 and fairly broad. t-3 is small and lanceolate. Exterior sensilla a and d are equal in length. b is a little broad and extremely long. c is a little shorter than d and located with d on the same niveau. e is shorter than c. f is long but does not surpass the tarsus. g is a little longer than e. Interior sensilla a' is strikingly broad. b' is missing. c' is not broad and a little longer than f. S-shaped seta subequal to claw in length, which has no inner tooth.

Middle and hind legs: Length of middle tarsus  $33\sim 38\ \mu$ , that of hind one  $37\sim 44\ \mu$ . Each of their claws  $12\sim 16\ \mu$  and has one prominent inner tooth.

Abdomen: On tergite I, 10 posterior setae are observed. The anterior setae 3 and 4 on tergites II-V, 1 and 3 on tergites VI-VII are all missing. Accessory setae of posterior row 1-a are small and near to 1 on tergites II-VII. On tergites II-VI, the posterior setae 3 are located anterior to the other. Only two posterior setae are seen on sternite I. The pectinated comb of tergite VIII consists of 6~7 small teeth of equal size. Abdominal appendages II-III are uni-segmented.

		T.	P.	S.
Th	I	4		4-2-6
	II-III	4-2-14		5-2-4
Abd.	I	4-10	(2)	3-2
	II-III	4-12	3	3-5
	IV-VI	4-12	3	3-8
	VII	4-14	2	3-8
	VIII	4-8-6	2	4
	IX	10	2	4
	X	10	1	4
	XI	4	1	6
	Telson	9		6

Holotype: 1 ♂ Uragami, City of Nagasaki (18 VIII. 1958. T. Yanase leg.).

The other specimens examined: 1 ♂ and 1 ♀ Uragami, Nagasaki (18. VIII. 1958 T. Yanase leg.).

Notes: The present species, *A. yanasei*, which is named in dedicating to Mr. Takeshi Yanase, Ôsaka Gakugei University, was collected by himself

from the campus of the Uragami Cathedral, in Nagasaki, where the second Atomic Bomb was dropped in August of 1945. It is closely near to *A. morikawai* Imadaté et Yosii, but may be distinguished by the absence of the anterior setae 1 on tergite VI and the presence of 10 posterior setae on tergite I. The length and position of foretarsal sensillae are also somewhat different.

*Acerentulus tosanus* n. sp.

(Pl. IV, figs. 26-28)

Total length of the body  $800\ \mu$  in expanded adults. Integument well chitinized and yellowish pigmented all over. Apodemes and tentorium well developed.

Head: Labrum somewhat protruded. Head oval,  $115\ \mu$  without labrum in length and  $74\ \mu$  in width. Pseudoculi ovate, bilocular and  $8\ \mu$  long. "Filamento di Sostegno" of maxilla unbranched and surpasses the maxillary branch of tentorium. Median pairs of cephalic setae weak and short, being  $15\ \mu$  or less.

Thorax: Dorsally, 4 anterior, 2 middle and 14 posterior setae are observed on meso- and metathorax. Ventrally, 5 anterior, 2 middle and 4 posterior setae are seen on each segment mentioned above.

Front legs: Tarsus  $74\ \mu$ , claw  $21\ \mu$ ,  $TR=3.5$ . The position and the shape of its sensillae are as in fig. 27 a-b. Setae  $\alpha$  1~7,  $\beta$  1~7,  $\gamma$  1~5 and  $\delta$  1~6 are present. Dorsal sensilla t-1 is short and clavate apically. t-2 is thin and a little long. t-3 is small and lanceolate. Exterior sensilla a is subequal to t-2 in length. b is broad and long. c and d are located near each other, thin, equal in length and a little shorter than b. e and f are also thin, but f is longer than e. g is subequal to e in length. Interior sensilla a' is distinctly broad. b' is lacking. c' is thin and a little shorter than f. S-shaped seta subequal to claw in length, which has no tooth at all.

Middle and Hind legs: Each tibia is provided with 13 setae, 4 distal, 4 middle and 5 basal ones. Length of tarsus  $33\sim36\ \mu$ , middle tarsus is a little shorter than the hind one. Claw  $14\sim16\ \mu$  long, and with one prominent inner tooth on each.

Abdomen: 10 posterior setae are observed on tergite I. The anterior setae 3 and 4 on tergite II-V, 3 on tergite VI and 1 and 3 on tergite VII are all quite absent. Among the posterior setae, 3 are located anterior to the other setae on tergites II-VI. The accessory setae 1-a of the posterior row are very small and near to 1 on tergites II-VII. On tergite VIII, the central

seta is absent, and 4 anterior, 8 middle and 6 posterior setae are observed. Ventrally, only 2 posterior setae are present on sternite I. Sternites II-III are provided with 5 posterior setae. The pectinated comb of tergite VIII is shown in fig. 28 b. It consists of about 10 teeth of irregular size and somewhat protruded on its inner posterior margin. The teeth of the protruded portion are very small. Abdominal appendages II-III are uni segmented.

		T.	P.	S.
Th.	I	4		(4-2-6)
	II-III	4-2-14		5-2-4
Abd.	I	4-10	2	3-2
	II-III	4-12	3	3-5
	IV-V	4-12	3	3-8
	VI	6-12	3	3-8
	VII	4-12	2	3-8
	VIII	4-8-6	2	4
	IX	10	2	4
	X	10	1	4
	XI	4	1	6
	Telson	9		6

Holotype: 1 ♀, Usa, Kôchi (14. VII. 1954, K. Morikawa leg.).

The other specimens examined: 3 ♀, Usa, Kôchi (14. VII. 1954, K. Morikawa leg.).

Notes: This new species, *A. tosanus* is near to *A. yanasei* n. sp. and the next species *A. nitidus* n. sp., but may be distinguished from the former by having the anterior setae 1 on tergite VI and the shape of the pectinated comb on tergite VIII. From the latter it is distinguished by the sensillae upon foretarsus, by the chaetotaxy of tergites VII-VIII and by the larger size of the body. It is also related to *A. morikawai* Imadaté et Yosii with respect to the abdominal chaetotaxy. But the pectinated combs on tergite VIII, the weak and short setae of body make the present species separable from *A. morikawai*.

***Acerentulus nitidus* n. sp.**

(Pl. IV, figs. 29-33)

Total length of the body 600  $\mu$  in expanded adults. Integument well chitinized and yellowish pigmented all over. Apodemes and tentorium well developed.

Head: Labrum a little protruded. Head oval,  $106\mu$  in lateral view without labrum in length and  $66\mu$  in the greatest width. Pseudoculi ovate, bilocular and  $7\mu \times 5\mu$ . "Filamento di Sostegno" of maxilla unbranched and surpasses the maxillary branch of tentorium. Median pairs of cephalic setae weak and short; being  $12\mu$  or less.

Thorax: Dorsally, 4 anterior, 2 middle and 14 posterior setae are observed on meso- and metathorax. Ventrally, mesothorax is provided with 11 setae, 5 anterior, 2 middle and 4 posterior ones. But metathorax has 13 setae; 7 anterior, 2 middle and 4 posterior ones.

Front legs: Tarsus  $56\sim 61\mu$ , claw  $17\sim 18\mu$ ,  $TR=3.3$ . The position and the shape of its sensillae are as shown in fig. 32 a-b. Setae  $\alpha$  1~7,  $\beta$  1~7,  $\gamma$  1~5 and  $\delta$  1~6 are present. Dorsal sensilla t-1 is short and clavate apically. t-2 is long and gently bowed. t-3 is small and lanceolate. Exterior sensilla a is long and surpasses the base of seta  $\gamma$  3. b is extremely long and not broad. c and d are shorter than b and near to each other. e is short and near to f, which is long and surpasses the tarsus. g is subequal to e in length. Interior sensilla a' is extremely broad. c' is equal to f in length, but a little broader. b' is missing. S-shaped seta is subequal to claw in length. Claw has no tooth.

Middle and hind legs: Middle tarsus  $25\sim 27\mu$ , hind one  $29\sim 32\mu$ . Their claws are  $13\sim 14\mu$  long and with one prominent inner tooth. Tarsi are provided with 12 setae; 4 distal, 4 middle and 4 basal ones.

Abdomen: All tergal principal setae are shorter than that of other Japanese

		T.	P.	S.
Th.	I	4		4-4-6
	II	4-2-14		5-2-4
	III	4-2-14		7-2-4
Abd.	I	4-10	2	3-2
	II-III	4-12	3	3-5
	IV-VI	4-12	3	3-8
	VII	0-14	2	3-8
	VIII	2-7-4	2	4
	IX	10	2	4
	X	10	1	4
	XI	4	1	4
	Telson	9		6

*Acerentulus* species. On tergite I, 10 posterior setae are present. The anterior setae 3 and 4 on tergites II-VI are missing. On tergite VII, the anterior setae are quite absent. The inner pair of the anterior setae on tergite VIII are missing, so only 2 anterolateral setae are present at that place. Middle row of the same tergite is provided with 3 pairs of setae and one unpaired median seta instead of the missing inner pair of the row in the other species. Sternite I has only two posterior setae, and sternite XI has no anterior pair of weak setae.

The pectinated comb of tergite VIII is shown in fig. 33. It has 14~18 minute teeth of unequal size along the posterior margin. Abdominal appendages II-III are uni-segmented.

Holotype: 1 ♂, Shiroyama, Matsuyama city, Ehime (11. X. 1955, K. Morikawa leg.).

The other specimens examined: 6 ♂ and 11 ♀, Shiroyama, Ehime (11. X. 1955, K. Morikawa leg.).

Notes: The new species, *A. nitidus* n. sp., is near to *A. tosanus* n. sp., but may be easily distinguished by the position of the sensillae e and f on foretarsus, by the absence of the anterior setae on tergite VII, and by the presence of the central seta on tergite VIII. The species is once reported, by its small size, as *Protutenromon* sp. (Imadaté 1956 a).

#### Genus *Nipponentomon* gen. nov.

Genotype: *Acerentomon nippon* Yosii, 1938.

Body elongate. Integument well chitinized and apodemes well developed.

Head oval, with labrum poorly developed; distal segment of maxillary palpus slender; "Filamento di Sostegno" of maxilla unbranched.

Thorax without spiracles; sensillae d and e upon foretarsus near to each other.

Abdominal appendage I two-segmented; II-III uni-segmented; Tergal pectines are well developed and unusual in position. They are always present on posterior margins of tergites IX-XI; pleurites IX-X and sternites IX-X; L-shaped pectines are present at least on both sides of tergites IX-X; chaetotaxy; tergites II-VII with 6~8 anterior and 12 posterior setae, but not with central seta. Sternites I-VI with 5 anterior setae. (abnormally with only 3 setae on I-III) In mature junior, abdominal sternites I-VI have only 3 anterior setae just like the genus *Acerentulus*. Sternites I, II-III and IV-



VI have each 4,5 and 8 posterior setae.

Notes: The new genus is distinguished from the genus *Acerentomon* by following points.

- (1) Pectinated structures are present on the posterior margin of tergites IX-XI, pleurites IX-X and sternites IX-X. L-shaped combs are seen on the anterolateral side of tergites IX-X.
- (2) The first six sternites are normally provided with 5 anterior setae in adult, (3 in mature junior) and sternite VII with 3 anterior setae.

The latter feature indicates the near relationship of the present new genus to the genus *Acerentulus* of the *A. danicus* group by the position of the sensillae d and e on foretarsus. In this respect, *Nipponentomon* gen. nov. seems to be intermittent between the genera *Acerentomon* and *Acerentulus*, although it is quite specialized in having remarkable abdominal pectines.

### *Nipponentomon nippon* (Yosii)

(Pl. V-VI, figs. 34-47)

*Acerentomon nippon* Yosii, 1938, Zool. Mag. (Tokyo) 50:398-400; Tokunaga, 1944, Medical Ent. 1:103; Gisin, 1945, Rev. suisse Zool. 52:530; Uchida, 1950, Iconogr. Ins. Jap. ed. 2:1; Paclt, 1954, Beitr. Ent. 4:667; —, 1955, Genera Insectorum 211:17.

Total length of the body 1,500~1,700  $\mu$  in fully expanded adults. Integument well chitinized and yellowish pigmented all over. Apodemes and tentorium well developed.

Head: Length 160~170  $\mu$ , in lateral view, labrum somewhat protruded to 22~28  $\mu$  long, LR=6.1~7.8. Second segment of maxillary palpus short, the distal segment slender. Pseudoculi circular, dorsolaterally situated, 10  $\mu$  ~8  $\mu$  and bilocular as usual. "Filamento di Sostegno" of maxilla unbranched and its proximal apex extends over the maxillary branch of tentorium. Median pairs of cephalic setae stout and long, being about 35  $\mu$ .

Thorax: Dorsal side of mesothorax with 6 anterior, 2 middle and 16 posterior setae. Metathorax with 8 anterior, 2 middle and 16 posterior ones. The latter has namely 1+1 more setae lateral to the anterior setae 3. Upon these two segments the anterior setae 1 are weaker and shorter than others of the same row and the posterolateral setae (4a) are minute and difficult to observe. Ventrally, prothorax with 4 anterior, 4 middle and 6 posterior setae. There being 2+2 setae on the middle row. Mesothorax has 5 anterior,

2 middle and 4 posterior setae. Metathorax is provided with 7 anterior, 2 middle and 4 posterior setae.

Front legs: Tarsus  $98\sim110\mu$ , claw  $37\sim45\mu$ ,  $TR=2.5\sim2.7$ . The position and the shape of its sensillae are as in fig. 37 a-b. Dorsally, setae  $\alpha$  1-7 are present. Sensilla t-1 is a little broad, gently bowed and not clavate. t-2 is thinner than t-1 and straight. t-3 is small and lanceolate. Ventrally, setae  $\beta$  1-7 are present. Exteriorly, setae  $\gamma$  1-5 are observed. Sensilla a is extremely long and located near to seta  $\gamma$  1. b is a little shorter than c. d is straight. d and e are located near to each other and subequal in length. f is extremely long, surpassing the tarsus. g short. Relative distances between c-d: d-e: e-f are represented as 3:1:2. Interiorly, setae  $\delta$  1-6 are present. Sensilla a' is missing. b' is located between  $\alpha$  4 and  $\delta$  3. c' is very long; with needle-like apex and is located near  $\beta$  7. S-shaped seta is a little shorter than the claw in length. Claw has one minute inner tooth.

Middle and Hind legs: Tarsus  $50\sim60\mu$ , claw  $18\mu$  in length. Middle tarsus is a little shorter and thicker than hind one. Both of them have one prominent tooth on the claw. Middle tarsus has 13 setae. 4 of them are situated near to the apex and are very small. Other 4 setae are located near the base and comparatively long. Additional 5 setae are found on its middle portion, 4 of which are as long as the basal one, while one seta is minute as that of the apical one. This last mentioned seta is not to be found on the hind tarsus, so that the latter has only 12 setae. Tibia, femur, trochanter and coxa of these legs are provided each with 8, 7, 3 and 5 setae.

Abdomen: Tergite I has 4 anterior and 10 posterior setae. Tergites II-VI with 8 anterior and 12 posterior setae (principal setae 1, 2, 3, 4 and accessory setae 1a, 2a). On tergite VII, the anterior setae 1 are missing. Sternites I-VI have 5 anterior setae. Sternite VII with 3 anterior and 9 posterior setae. Pectinated comb on both sides of tergite VIII is curious. Beside the normal comb of 7-10 small teeth along the posterior margin of the segment, there exists another row of numerous minute teeth a little proximal to the usual comb. These anterior teeth are distinctly observed only in well expanded specimens. Pectinated structures which consist of numerous small teeth are found also on tergites IX-XI, pleurites IX-X and sternites IX-X. L-shaped pectines, which consist of 4-5 longitudinal and 8-10 transverse teeth as shown in fig. 39, are located near to the lateral margin of tergites IX-X. Abdominal appendage I two-segmented and with 4 setae, II, III uni-segmented

and each with 2 setae.

		T.	P.	S.
Th.	I	4		4-4-6
	II	6-2-16		5-2-4
	III	8-2-16		7-2-4
Abd.	I	4-10	2	5-4
	II-III	8-12	3	5-5
	IV-VI	8-12	3	5-8
	VII	6-14	2	3-9
	VIII	4-7-6	2	4-2
	IX	10	1	4
	X	8	1	4
	XI	4	1	6
	Telson	9		6

Specimens examined: 1 ♂ (Holotype) and 1 ♀, Mt. Shizu-ga-také, Shiga (14. XI. 1957, R. Yosii leg.), 1 ♂ and 1 ♀, Ibid. (20. XII. 1955, G. Imadaté leg.). 1 mature junior, Ashû Kyoto (20. VIII. 1956, R. Yosii leg.). 1 ♂ (Preimago) and 2 mature junior, Kita-Shirakawa, Kyoto (22. VI. 1955, S. Uéno leg.). 5 ♂, 4 ♀, 3 preimago, 6 mature junior, 15 Larva II and 1 Larva I, Uji, Kyoto (24. IV. 1955~14. XII. 1956, R. Yosii leg.). 1 Larva II, Nara, Nara (28. V. 1954, G. Imadaté leg.). 1 ♂, Shiroyama, Ehimé (26. I. 1955, K. Morikawa leg.). 6 ♂ and 5 ♀, Sugitaté, Ehimé (14. IV, 18. IX. 1954, K. Morikawa leg.). 3 ♂ and 7 ♀, Mizu-ga-tôgé, Ehimé (12. X. 1954, K. Morikawa leg.). 1 ♀, Ôno-ga-hara, Ehimé (3. VIII. 1954, K. Morikawa leg.).

Notes: A considerable number of the larval forms of *N. nippon* have been collected from Kyoto and its vicinity during 1954~1956. The following table indicates the monthly occurrence of these larval stages.

	Larva I	Larva II	Mature junior
Jan.-Mar.	0	0	0
Apr.	0	1	2
May	1	15	2
June	0	0	3
July-Aug.	0	0	0
Sept.	0	0	1
Oct.-Dec.	0	0	0
	0	16	8

Prelarva has not yet been found. In comparison with the datum on *Acerentlu'us danicus* Condé in Denmark given by Tuxen (1949), the occurrence of the present species seems to be a little earlier. That one specimen of mature junior is found in September is something puzzling.

**Notes on the postembrionic development :**

(1) **Larva I** (Pl. V, figs. 40-41); Body length 700  $\mu$ . Integument poorly chitinized and a little pigmented all over the body. Abdomen 9-segmented, apodemes and tentorium slightly devoped. Head oval, 106  $\mu$  in length without labrum. Labrum poorly developed, 17  $\mu$  long. Pseudoculi 7  $\mu \times 7 \mu$ , bilocular and ovate. "Filamento di Sostegno" alike to that of imago in shape, but smaller and thinner. Foretarsus 59  $\mu$ , claw 24  $\mu$ , with one inner tooth. Middle and hind tarsi 30-34  $\mu$ , claw 14  $\mu$ . The anterior setae are absent on all abdominal tergites and on sternites I-III and VIII. One central seta of the anterior row is present on sternites IV-VII. Pectinated comb on both sides of tergite VIII has 7-9 distinct teeth on posterior margin and indistinct minute teeth on anterior margin. Pectinated band on tergite VIII is present.

(2) **Larva II** (Pl. VI, figs. 42-43, 46); Body length 800-1,000  $\mu$ . Integument more chitinized than in the former stage and last 5-6 segments are yellowish pigmented. Abdomen 10 segmented, apodemes and tentorium developed. Head 112-115  $\mu$  in length without labrum. Labrum poorly developed and 18  $\mu$  long. Pseudoculi bilocular, ovate. "Filamento di Sostegno" unbranched and surpasses the maxillary branch of tentorium. Foretarsus 76-80  $\mu$ , its claw 28-30  $\mu$ , with one inner tooth. Sensillae and setae upon tarsus well coincides with that of imago beside the shape of exterior sensilla b which is distinctly thicker than that of imago. Middle and hind tarsi 40-42  $\mu$ . Claw 18-20  $\mu$  and with one prominent inner tooth. Their coxa, trochanter, femur and tibia are provided each with 5, 3, 7 and 8 setae. Middle tarsus with 13 setae and hind tarsus with 12 setae. Abdominal tergites I-VII without anterior setae. Sternite I with 3 anterior setae. Sternites II-VII have one anterior central seta. Pectinated comb of tergite VIII is already well represented as in the adults, there being distinct anterior and posterior row of teeth. The latter is, however, somewhat irregularly formed. Pectinated structures are also found on tergite IX, pleurites VIII-IX and sternite IX. L-shaped combs are indistinct.

(3) **Mature junior** (Pl. VI, figs. 44-45, 47); Body length 1,200-1,500  $\mu$ . Integument well chitinized and yellowish pigmented, but body colour is a little lighter than that of imago. Abdomen 12 segmented, apodemes and

tentorium well developed. Head  $138\sim143\mu$  in length without labrum, labrum  $23\mu$ , Pseudoculi  $10\mu\sim8\mu$ , oval and bilocular. "Filmento di Sostegno" unbranched. Median pairs of cephalic setae stout and long,  $30\mu$  in length. Foretarsus  $84\sim90\mu$ , claw  $28\sim32\mu$ . Sensilla b on the exterior face of the tarsus is a little thicker than that of imago but thinner than in larva II. Middle and hind tarsi  $47\mu$ , each of their claws  $22\mu$ . On abdominal tergites I–VIII appear 4~8 anterior setae. Sternites I–VII with 3 anterior setae. Pectinated comb of tergite VIII has almost fully developed posterior row and small anterior row of teeth. L-shaped combs on tergites IX and X are represented by several weakly developed teeth in a transverse row, not yet forming true L-shape. Other pectinated structures on tergites IX–XI, pleurites IX–X and sternites IX–X are already as those of imago.

(4) **Preimago**; Body length  $1,300\sim1,500\mu$ . Head  $145\mu$ , labrum  $32\sim34\mu$ . Foretarsus  $92\mu$ , claw  $34\mu$ . Sensilla b of the tarsus like that of mature junior. Beside the shape of genital organ, the present stage coincides well with the imago with respects to the chaetotaxy and pectinated structures.

**Chaetotaxy**: From the process of the development of chaetotaxy which is tabulated in the next page, there may be deduced the following conclusion. Dorsally, the principal setae of posterior row of each abdominal segment appear already completely in larva I, and its accessory setae complete in larva II. The anterior row of setae upon these segments appear in mature junior, i.e. after the completion of the posterior row. Ventrally, the process is almost equal to that of European *Acerentulus* species summarised by Tuxen (1949). An important difference is that the sternal chaetotaxy completes already in the stage of mature junior in all European *Acerentulus* species, while it is not yet complete at that stage in our *Nipponentomon*. The preimago of *Nipponentomon* has namely one pair of more setae on the anterior row on sternites I–VI. This feature shows that *Nipponentomon* is phylogenetically more advanced compared with *Acerentulus* species and seems to comprise one of the remarkable characteristics of the genus. For the moment, the development of *Nipponentomon* cannot be compared with that of true *Acerentomon*, because no detailed description is available.

**Pectinated structures**: The pectinated comb of tergite VIII appears from larva I onwards both in anterior and posterior row of teeth. The posterior teeth are, however, in larva I and II, irregular in arrangement and in shape, but already in adult forms when they are in mature junior. Larva II has,

		Larva I		Larva II		Mature junior		Preimago		Imago	
					Newly appeared setae are		Newly appeared setae are		Newly appeared setae are		Newly appeared setae are
(Dorsal)											
Th.	I	4	4			4		4		4	
	II	2-2-8	4-2-12	A2, P 1a, 3a		6-2-16	A3, P 2a, 4a	6-2-16		6-2-12	
	III	2-2-8	4-2-12	A2, P 1a, 3a		8-2-16	A3, 4, P 2a, 4a	8-2-16		8-2-16	
Abd.	I	0-6	0-10	P 1a, 2a		4-10	A1, 2	4-10		4-10	
	II-III	0-8	0-12	P 1a, 2a		6-12	A1, 2, 4	8-12	A3	8-12	
	IV	0-8	0-12	P 1a, 2a		6-12	A1, 2, 4	8-12	A3	8-12	
	V-VI	0-8	0-12	P 1a, 2a		6(8)-12	A1, 2(3), 4	8-12	A3	8-12	
	VII	0-8	0-14	P 1a, 2a, 4a		6-14	A1, 2, 4	6-14		6-14	
	VIII	0-6-4	2-7-6	A2 Mc, P3		4-7-6	A1	4-7-6		4-7-6	
	IX	-	6			8(10)	2	10	4	10	
	X	-	-			6(8)	1, 2, 4	8	3	8	
	XI	-	-			4	1, 2	4		4	
Telson		9	9			9		9		9	
(Pleural)											
Abd.	I	0-1	0-1			1-1	A	1-1		1-1	
	II-VI	0-1	1-1	A		1-2	P2	1-2		1-2	
	VII	0-1	0-1			1-1	A	1-1		1-1	
	VIII	0-1	0-1			1-1	A	1-1		1-1	
	IX	-	1	1		1		1		1	
	X	-	-			1	1	1		1	
	XI	-	-			1	1	1		1	
(Ventral)											
Th.	I	2-2-2	2-2-4	P2		4(2)-4-6	(A2), M2, P3	4-4-6		4-4-6	
	II	5-0-2	5-2-2	M		5-2-4	P2	5-2-4		5-2-4	
	III	5-0-2	5-2-2	M		7-2-4	A3, P2	7-2-4		7-2-4	
Abd.	I	0-2	3-2	Ac, A1		3-4	P1	5-4	A1	5-4	
	II-III	0-3	1-5	Ac, P1		3-5	P2	5-5	A1	5-5	
	IV-VI	1-4	1-6	P4		3-8	A2, P2	5-8	A1	5-8	
	VII	1-4	1-6	P4		3-8	A2, P2	3-8(9)		3-9	c
	VIII	2-0	4-0	M1		4-2	P1	4-2		4-2	
	IX	-	4	1, 2		4		4		4	
	X	-	-			4	1, 2	4		4	
	XI	-	-			2	2	6(4)	1(3)	6	
Telson		8	8			6(8)	(-A)	6		2	

surprisingly, a pair of comb comprising from 2~3 teeth near the sternal margin of pleurite VIII. As the structure is present in all examples of larva II examined, but is absent neither in larva I nor in mature junior, and as the place coincides with the well represented comb of the genus *Acerentomon*, it may be regarded as homologous to the pleural pectine of the cited genus. The presence of such vestigial organ in the order Protura is highly interesting. The pectinated teeth on the posterior margin of abdominal segments IX-XI

increase in number with development, viz. the posterior pectine located between both sides of setae 1 on tergite IX has 5~7 teeth in larva II, 10~14 in mature junior, 16~20 in preimago and imago. Side by side with the growth in number, their shape becomes larger. L-shaped combs on tergite IX-X appear in larva II as a transverse row of some 4~6 teeth. In mature junior the structures are almost unchanged. The true L-shaped combs as those of the imago may be observed in preimago stage.

***Nipponentomon sawadai* (Imadaté)**

(Text-fig. 2, Pl. VI, fig. 48)

*Acerentomon sawadai* Imadaté, 1956, New Entomologist 5 (1/2): 23-27.

Body 970~1,200  $\mu$  long in adult, in extended condition. Integument well chitinized and yellowish pigmented. Apodemes and tentorium well developed.

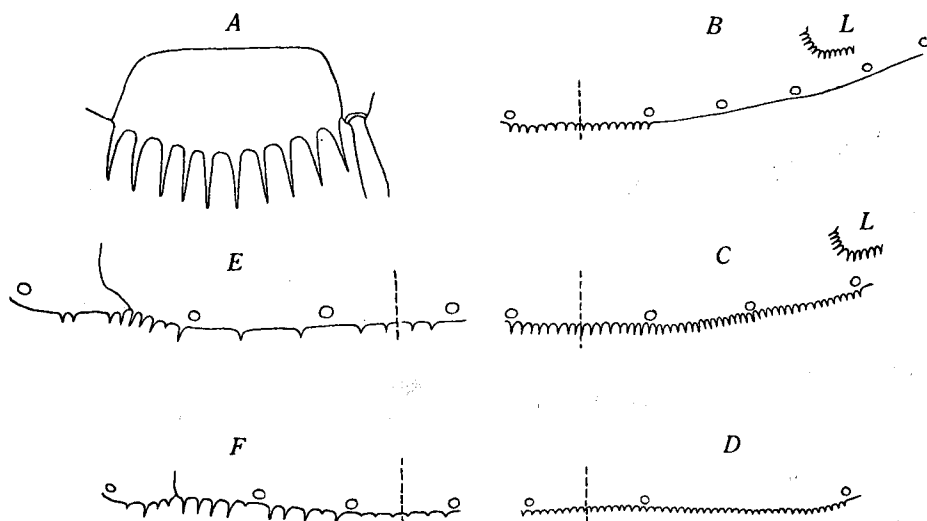
Head: 130~140  $\mu$ . Labrum very poorly developed and attains only to 12~13  $\mu$  in length, LR=10.5-11.0. Second segment of maxillary palpus short, the distal one long and slender. Pseudoculi small, 9  $\mu \times$  8  $\mu$ , oval and bilocular. "Filamento di Sostegno" of maxilla unbranched, its proximal end extending beyond the maxillary branch of tentorium.

Front legs: Tarsus 75~90  $\mu$ , claw 25~30  $\mu$ , TR=3.0. Upon tarsus, dorsal setae  $\alpha$  1-7 are present. Sensilla t-1 is a little broad, gently bowed and not clavate. t-2 is thinner than t-1 and straight. t-3 is small and lanceolate. Ventral setae  $\beta$  1-7 are present. Exterior setae  $\gamma$  1-5 are observed. Sensilla a is long. b is subequal to c in form and length. d and e are located near to each other. Relative distances between c-d: d-e: e-f are represented as 14:3:10. f is extremely long, surpassing the tarsus. g is short. Interior setae  $\delta$  1-6 are present. Sensilla a' is missing. b' is located near to seta  $\alpha$  1 and subequal to c' in length.

Middle and Hind legs: Tarsus 45~50  $\mu$  and claw 18  $\mu$  in length. Middle tarsus in a little shorter and thicker than hind one. Both of them have one prominent inner tooth of the claw.

Thorax and Abdomen: The chaetotaxy of the present species coincides well with *N. nippon* as shown in the next table.

Abdominal segments I-VII have no comb-like structure. Pectinated comb on both sides of tergite VIII consists of 10~11 posterior teeth of equal size and is not observed any anterior teeth. Tergite IX has a pectine with about 15 teeth at about the middle of the posterior margin and on both sides of



Text-fig. 2 a-f: *Nipponentomon sawadai* (Inadaté). Pectinated structures of abdominal segments (a-Tergite VIII, b-Tergite IX, c-Tergite X, d-Tergite XI, e-Sternite and pleurite IX, f-Sternite and pleurite X).

		T.	P.	S.
Th.	I	4		4-4-6
	II	6-2-16		5-2-4
	III	8-2-16		7-2-4
Abd.	I	4-10	2	5-4
	II-III	8-12	3	5-5
	IV-VI	8-12	3	5-8
	VII	6-14	2	3-9
	VIII	4-7-6	2	4-2
	IX	10	1	4
	X	6	1	4
	XI	4	1	6
	Telson	9		6

setae 1. Pectinated structures with numerous small teeth are present on tergites X-XI. L shaped pectines with about 12 teeth are present on both sides of tergites IX and X. Small teeth are also observed along the posterior margin of sternites IX, X and pleurites IX, X.

Specimen examined: 1 ♂ (Holotype) Mt. Nantai, Nikko, Tochigi (13. XI. 1953, K. Sawada leg.).

Notes: The present species may be distinguished from others by the pecti-



nated comb on tergite VIII, value of LR, TR, the relative length and distance of sensillae upon foretarsus.

*Nipponentomon dimorphum* n. sp.

(Pl. VI, figs. 49-51)

Length of the body  $1,280\ \mu$  in fully extended adults. Integument well chitinized and yellowish pigmented. Apodemes and tentorium well developed.

Head:  $175\ \mu$  in length, labrum poorly protruded to  $22\ \mu$ ,  $LR=8.0$ . Pseudoculi oval and biocular. "Filamento di Sostegno" of maxilla unbranched, distinctly thin and curved, its proximal end extending beyond the maxillary branch of tentorium. Second segment of maxillary palpus short and the distal one long and slender.

Front legs: Tarsus  $106\ \mu$ , claw with one inner tooth,  $43\ \mu$  long,  $TR=2.5$ . The position and the shape of its sensillae are as in fig. 50. Setae  $\alpha$  1-7,  $\beta$  1-7,  $\gamma$  1-5 and  $\delta$  1-6 are present. Dorsal sensilla t-1 is a little broad, gently bowed and not clavate. t-2 is thinner than t-1. t-3 is small and lanceolate. Sensilla a long, b broader than other exterior sensillae c, d and e thin and subequal in length. Relative distances between c-d: d-e: e-f are represented as 5:1:3. f extremely long and surpassing the tarsus, g short. Interior sensilla a' lacking, b' a little thicker than c'.

Middle and Hind legs: Tarsus  $56\sim 66\ \mu$ , claw  $25\ \mu$ , with one prominent tooth.

Thorax and Abdomen: Chaetotaxy is as shown in the next table.

		T.	P.	S.
Th.	I	4		4-4-6
	II	6-2-16		5-2-4
	III	8-2-16		7-2-4
Abd.	I	4-12	2	5-4
	II-III	8-12	3	5(4)-5
	IV-VI	8-12	3	5-8
	VII	10-14	2	5-9
	VIII	4-7-6	2	4-2
	IX	10	1	4
	X	8	1	4
	XI	4	1	6
	Telson	9		6

On tergite VIII, the pectinated comb on both sides with 9~10 posterior teeth and numerous anterior teeth just like in *N. nippon*. In one male specimen a row of small teeth is observed at the posterior margin of tergite VIII, lateral to the pectinated comb. While, one female specimen has a row of small teeth on the posterior margin between the pectinated comb of both sides. Tergite IX has a row of small teeth at the posterior margin and between both sides of setae 1. Pectinated structures with numerous small teeth are present also on tergites X-XI, pleurites IX-X and sternites IX-X. L-shaped pectines are indistinct.

Holotype: 1 ♂, Nanao, Ishikawa (23. XI. 1957, G. Imadaté leg.). Allotype: 1 ♀, Nanao, Ishikawa (23. XI. 1957, G. Imadaté leg.).

Notes: The present species may be distinguished from *N. nippon* by the presence of the pectinated structures on the posterior margin of tergite VIII, as well as by the shape of sensilla b on foretarsus and the number of the posterior setae on tergite I. That the pectinated structures on tergite VIII are possibly sexually dimorphic is remarkable. More materials are needed to investigate accurately their variability.

*Nipponentomon uenoi* n. sp.

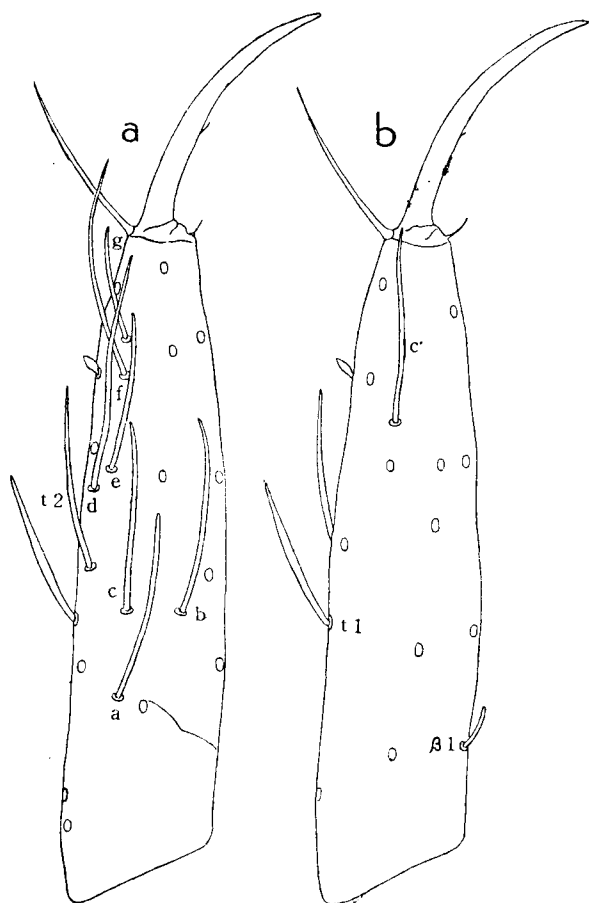
(Text-fig. 3, Pl.VII, figs. 52-57)

Body 1,500~1,800  $\mu$  long in adult, in extended condition. Integument well chitinized and ye'lowish pigmented. Apodemes and tentorium well developed.

Head: 180  $\mu$  long, in lateral view; 140  $\mu$  in breath, in dorsal view. Labrum very poorly developed, being only 14  $\mu$  in length. The ratio: LR=12.9. Pseudoculi small 11  $\mu$   $\times$  6  $\mu$ , oval and bilocular. "Filamento di Sostegno" of maxilla unbranched, its proximal end extending beyond the maxillary branch of tentorium. Second segment of maxillary palpus short, the distal one long and slender.

Thorax: Meso- and metathorax are provided with accessory setae 1a, 1a', 2a and 2a' on the posterior margin. There are two accessory setae present between principal setae 1-2 and 2-3. These accessory setae are very small, only 9  $\mu$  long and the principal one long, 60~90  $\mu$  in length. Lateral accessory setae (4a) always present near the anterior margin, but very minute and not easy to find.

Front legs: Tarsus 125  $\mu$  long. Claw with one inner tooth, 55  $\mu$  long, TR=2.3. The position and the shape of its sensillae are as in text-fig. 3 a-b.



Text-fig. 3 a-b: *Nippontomon uenoi* n. sp. Foretarsus in exterior and interior view

Setae  $\alpha$  1-7,  $\beta$  1-7,  $\gamma$  1-5 and  $\delta$  1-6 are present. Dorsal sensilla t-1 is a little broad, gently bowed and not clavate. t-2 slightly shorter than t-1. t-3 is short and lanceolate. Sensilla a is normal and subequal to b and c in form and length. d is extremely long. d and e are located near to each other. The ratio of the distances between c-d; d-e; e-f are 13.3:4.3:10. f is long and surpasses the tarsus. g is short. Sensilla a' and b' are not observed. c' is present. Seta  $\beta$  1 is very short and truncate. S-shaped seta is a little longer than  $1/2$  of claw.

Middle and hind legs: Their tarsi are  $80\mu$  long, claw with one inner tooth,  $25\mu$  long.

		T.	P.	S.
Th.	I	4		4-4-6
	II	6-2-20		5-2-4
	III	8-2-20		7-4-4
Abd.	I	6-10	2	3-4
	II	8-14	3	3(4)-5
	III	8-14	3	5(3, 4)-6
	IV-VI	8-14	3	5-8
	VII	6-14	2	3-9
	VIII	4-7-4	2	4-2
	IX	10	1	4
	X	8	1	4
	XI	4	1	6
	Telson	9		6

Abdomen: Of 8 specimens examined, some chaetotaxic variations are observed, viz. 1 ♂ has the posterior setae 2a' on tergite III and the number of the anterior setae on sternites II-III are 3-3 in 1 ♀, 3-4 in 1 ♀, 4-5 in 1 ♂ and 4-4 in 1 ♀. There are accessory setae 3a, between the principal setae 3 and 4 on the posterior row of tergites II-VI, but the accessory setae of tergite VII are absent. Pectinated comb of tergite VIII consists of 7-9 small posterior teeth nearly equal in size. The anterior teeth are very indistinct. Both sides of the anterior margin of Abdominal segments II-VI have lateral pectines composed of minute irregular teeth. Furthermore, the ventral margin of each pleurite (II-VI) are fringed with very minute, almost invisible serrations on their anterior  $1/3-1/2$ . Abdominal segments IX-XI have some pectinated structures; tergite IX has a pectinated structure of about 15 teeth at the posterior margin and between both sides of setae 1 and between setae 3-5. L-shaped comb of about 20 teeth is present near setae 4. Pleurite IX has 6-8 minute teeth at the sternal side. All along the posterior margin of sternite IX with small teeth. Tergite X has a posterior row of numerous teeth ranging between setae 4. L-shaped comb alike to tergite IX is also present. Pleurite X is provided with 6-8 teeth as on pleurite IX. Sternite X has small teeth all along the posterior margin. They are unequal in shape and larger than those of the precedent sternite. Posterior margin of tergite XI bears many minute teeth. Pleurite XI has also several minute teeth.

Holotype: 1 ♂, Terayama-no-ana Cave, Akiyoshi, Yamaguchi. (24. XI. 1956, G. Imadaté leg.). Other specimens examined: 2 ♂ and 5 ♀, Terayama-no-ana Cave, Yamaguchi (24. XI. 1956, G. Imadaté leg.).

Notes: All the materials have been found in debris near the entrance of a ponor, Terayama-no-ana Cave by using Berlese's funnel. As it was impossible to collect them from the inner parts of the cave, it is probably not troglomorphic in nature. The present species is conspicuous in having the lateral pectines on tergites II-VI as well as by chaetotaxy of thoracic tergites. Sensilla d of foretarsus is extremely long. The species is named in honour of Prof. M. Uéno, president of the Biospeological Club in Japan.

*Acerentomon yamato* (Imadaté et Yosii)

(Pl. VIII, figs. 58-63)

*Acerentulus yamato* Imadaté et Yosii, 1956, Ins. Mats., 20 (1/2): 11-14.

Length of the body 1,400~1,800  $\mu$ , in extended adults. Integument well chitinized and yellowish pigmented. Apodemes and tentorium well developed.

Head: Length 180  $\mu$ , breadth 110  $\mu$ . Labrum slightly protruded to 8  $\mu$  long. Pseudoculi ovate and bilocular. "Filamento di Sostegno" of maxilla unbranched and surpasses the maxillary branch of tentorium. The distal segment of maxillary palpus is short, not slender, but a little longer than the second one.

Thorax: Dorsal anterior row with 6 setae and without setae 4 on mesothorax, 8 setae on metathorax. Ventral anterior row with 5 setae on mesothorax and 7 setae on metathorax.

Front legs: Tarsus 108~122  $\mu$  in length, claw 36~46  $\mu$ , with an inner tooth, TR=2.6~2.8. Setae  $\alpha$  1-7,  $\beta$  1-7,  $\gamma$  1-5 and  $\delta$  1-6 are present.

Dorsal sensilla t-1 short and clavate apically, t-2 thinner but longer than t-1, t-3 lanceolate. Exterior sensilla a and c equal in length, longer than d and e. b extremely long. f also long and surpassing the tarsus. g short. Interior sensilla a' broad and long. b' missing and c' thin.

Middle and hind legs: Middle tarsus 66  $\mu$  long, hind one 71  $\mu$ . Claw 24  $\mu$  and 27  $\mu$  in a largest specimen with a prominent tooth.

Abdomen: On tergite I, the anterior setae 3 are present. On tergites II-VI, principal setae 1, 2, 3, 4 and accessory setae 1a, 2a and 3a are present at the posterior row. The number of the anterior setae of sternites I-VII are 3, 5, 5, 6, 6, 6(7), 5 and therefore typically built for *Acerentomon*.

		T.	P.	S.
Th.	I	4		4-4-6
	II	6-2-16		5-2-4
	III	8-2-16		7-2-4
Abd.	I	6-10	2	3-4
	II-III	8-14	3	5-5
	IV-V	8-14	3	6-8
	VI	8-14	3	6(7)-9(8)
	VII	10-14	2	5-9
	VIII	6-7-6	2	4
	IX	10	2	4
	X	8(6)	1	4
	XI	4	1	6
	Telson	4		6

Beside pectinated comb on both sides of tergite VIII which is protruded at the posterior margin, abdominal segments VIII-X have some pectinated structures. The posterior margin of pleurite VIII is provided with numerous small teeth. Tergite IX-X are provided each with a row of small teeth at the posterior margin near to setae 4 (tergite IX) or setae 3 (tergite X) of both sides.

Specimens examined: 1 ♂ (Holotype) Nara, Nara (25. II. 1955, G. Imadaté leg.), 7 ♂ and 3 ♀ (15. II. 1955, G. Imadaté leg.), 1 ♀, Yoshino, Nara (6. VIII. 1954, G. Imadaté and C. Tsutsumi leg.), 1 ♀, Yakushi-tôge, Kyoto (14. IV. 1938, R. Yosii leg.), 3 ♂, Minô, Ôsaka (1. I, 18.~IV, 27. XII. 1953, K. Sawada leg.)

Notes: Although we placed the present species for the first time to the genus *Acerentulus* by the absence of rostrum and by the shape of maxillary palpus, it should be removed to the genus *Acerentomon* by the following reasons:

1. Number of the anterior setae of sternites I-VII are 3, 5, 5, 6, 6, 6 (7), 5., typical for *Acerentomon*.
2. The posterior margin of pectinated comb on tergite VIII are distinctly protruded.
3. Pectinated structures are present on pleurite VIII, tergites IX and X.
4. The position of exterior sensilla d and e upon foretarsus well coincides with those of the European *Acerentomon* species.

The following two forms are also to be treated to belong to *Acerentomon* by the same reason. But, as all these three have the comparatively small and short third segment of maxillary palpus and the rostrum almost not developed, they are to be regarded to form a special group within the genus.

### *Acerentomon lubricum* (Imadaté)

(Pl. VIII, figs. 64-66)

*Acelentulus lubricus* Imadaté, 1956, Trans. Shikoku Ent. Soc., 4(7): 104-105.

Length of the body 1,100~1,400  $\mu$ . Integument well chitinized and yellowish pigmented.

Head: Length 140~150  $\mu$ , breadth 85  $\mu$ . Labrum poorly developed to 9  $\mu$ . Pseudoculi ovate and bilocular and measures 10  $\mu$   $\times$  8  $\mu$ . "Filamento di Sostegno" unbranched and surpasses the maxillary branch of tentorium. The distal segment of maxillary palpus is short, not slender, but a little longer than the second one as in *A. yamato*.

Front legs: Tarsus  $90\sim 114\mu$  in length, claw  $37\sim 40\mu$ , with an inner tooth,  $TR=2.5-2.7$ . Setae  $\alpha$  1-7,  $\beta$  1-7,  $\gamma$  1-5 and  $\delta$  1-6 are present. Dorsal sensilla t-1 is fairly broad and long, gently bowed and not clavate. t-2 thinner, straight and equal to t-1 in length. t-3 small and lanceolate. Exterior sensilla a thick and long. b is extremely long and thin. c, d and e subequal in length and thin. Relative distances between c-d:d-e:e-f are represented as 11:11:9. f long and surpassing the tip of the tarsus. g short and thin. Interior sensilla a' thin and long. b' missing, c' present.

Middle and hind legs: Tarsus  $60\sim 72\mu$ , claw  $25\sim 27\mu$ , with one prominent tooth.

Thorax and Abdomen: Chaetotaxy of each segment as in the next table.

		T.	P.	S.
Th.	I	4		4-4-6
	II	6-2-16		5-2-4
	III	8-2-16		7-2-4
Abd.	I	8-10	2	3-4
	II-III	10-12	3	5-5
	IV-V	10-14	3	6-8
	VI	10-16	3	6-8
	VII	10-16	2	5-9
	VIII	6-7-4	2	4
	IX	10	2	4
	X	6	1	4
	XI	4	1	6
	Telson	9		6

On abdominal tergite I, 4 pairs of anterior setae are present. The accessory setae 3a of posterior row are quite absent on tergites II and III. Tergites II-VI have 5 pairs of setae on each anterior row. On tergite VI, there are two accessory setae, 1a and 1a', present between principal setae 1 and 2. The abnormality of chaetotaxy has already been mentioned in the previous paper. Pectinated comb on both sides of tergite VIII is protruded at the posterior margin and consists of about 20 teeth of a little irregular form. Pectinated structures on pleurite VIII and tergites IX and X are present at the posterior margin. Abdominal appendage I two-segmented with 4 setae and II, III uni-segmented each with 2 setae.

Specimens examined: 18 ♂ and 12 ♀ (including Holotype), Mt. Sara-ga-

miné, Ehimé (30. XII. 1954, K. Morikawa leg.). 2 ♂ and 4 ♀, Shiroyama, Ehimé (26. I. 1955, K. Morikawa leg.). 4 ♂ and 5 ♀ Sugitate, Ehimé (5. I. 1955, K. Morikawa leg.). 1 ♂, Tsukuho, Fukuoka (5. I. 1957, S. Miyako and G. Imadaté leg.).

Notes: The present species is also to be transferred to *Acerentomon* by reasons mentioned above. The species is conspicuous having two accessory setae 1a and 1a' between principal setae 1 and 2 of posterior row on tergite VI as well as in having anterior setae 5 on tergites II-VI. Dorsal sensilla t-1 upon foretarsus in this species is long and not clavate like in *A. takanawanum*.

*Acerentomon takanawanum* (Imadaté)

(Pl. VIII, figs. 67-68)

*Acerentulus lubricus takanawanus* Imadaté, 1956, Trans. Shikoku Ent. Soc., 4(7): 105-106.

Body length 1,050~1,400  $\mu$  in extended adults. Integument well chitinized and yellowish pigmented. Apodemes and tentorium well developed.

Head: Length 140~150  $\mu$ , breadth 80  $\mu$ . Labrum poorly developed to 11~12  $\mu$ . Pseudoculi small and bilocular. "Filamento di Sostegno" of maxilla unbranched and surpasses the maxillary branch of tentorium. The distal segment of maxillary palpus is short, not slender but a little longer than the second one.

Front legs: Tarsus 106~120  $\mu$ , claw 40~44  $\mu$ , with one inner tooth TR=2.7. The position and the shape of its sensillae as in fig. 67. Setae  $\alpha$  1~7,  $\beta$  1~7,  $\gamma$  1~5 and  $\delta$  1~6 are present. Dorsal sensilla t-1 is a little broad, gently bowed and not clavate apically, t-2 thinner than t-1 and straight, t-3 small and lanceolate. Exterior sensilla a long, b extremely long. Relative distances between sensillae c-d: d-e: e-f are represented as 14:7:13. f long and surpassing the tarsus. g short. Interior sensilla a' a little broad. d' missing and c' thin.

Thorax and abdomen: Chaetotaxy of each segment as in the next table. On tergites II-VI, principal setae 1, 2, 3, 4 and accessory setae 1a, 2a and 3a are present. Pectinated comb on both sides of tergite VIII is protruded from the posterior margin and consists of about 20 teeth of a little irregular form. Pectinated structures on pleurite VIII and tergite IX are present at the posterior margin, but that of tergite X is indistinct. Abdominal ap-



pendage I two-segmented with 4 setae and II, III uni-segmented each with 2 setae.

		T.	P.	S.
Th.	I	4		4-4-6
	II	6-2-16		5-2-6
	III	8-2-16		7-2-4
Abd.	I	6-10	2	3-4
	II-III	8-14	3	5-5
	IV-V	8-14	3	6(5)-8
	VI	8-14	3	6(5)-9(8)
	VII	10-16	2	5-9
	VIII	6-7-6	2	4
	IX	10	2	4
	X	6	1	4
	XI	4	1	6
	Telson	9		6

Specimens examined: 3 ♂ and 1 ♀ (including Holotype), Mt. Takanawa, Ehime (23. X. 1955, K. Morikawa and T. Yano leg.).

Notes: The present form should be regarded as an independent species different from *A. lubricum* by the foretarsal sensillae and the abdominal chaetotaxy. From *A. yamato*, it may be distinguished by the shape of dorsal sensilla t-1 upon foretarsus.

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(\* not directly referred)

Plate I

*Eosentomon tuxeni* n. sp.

Figs. 1—2: Dorsal and ventral chaetotaxy.

Fig. 3 a-d: Foretarsus in exterior and interior view.

Fig. 4 a-b: Hindtarsus in exterior and interior view.

Fig. 5 a-b: Male and female genital organs.

Plate I

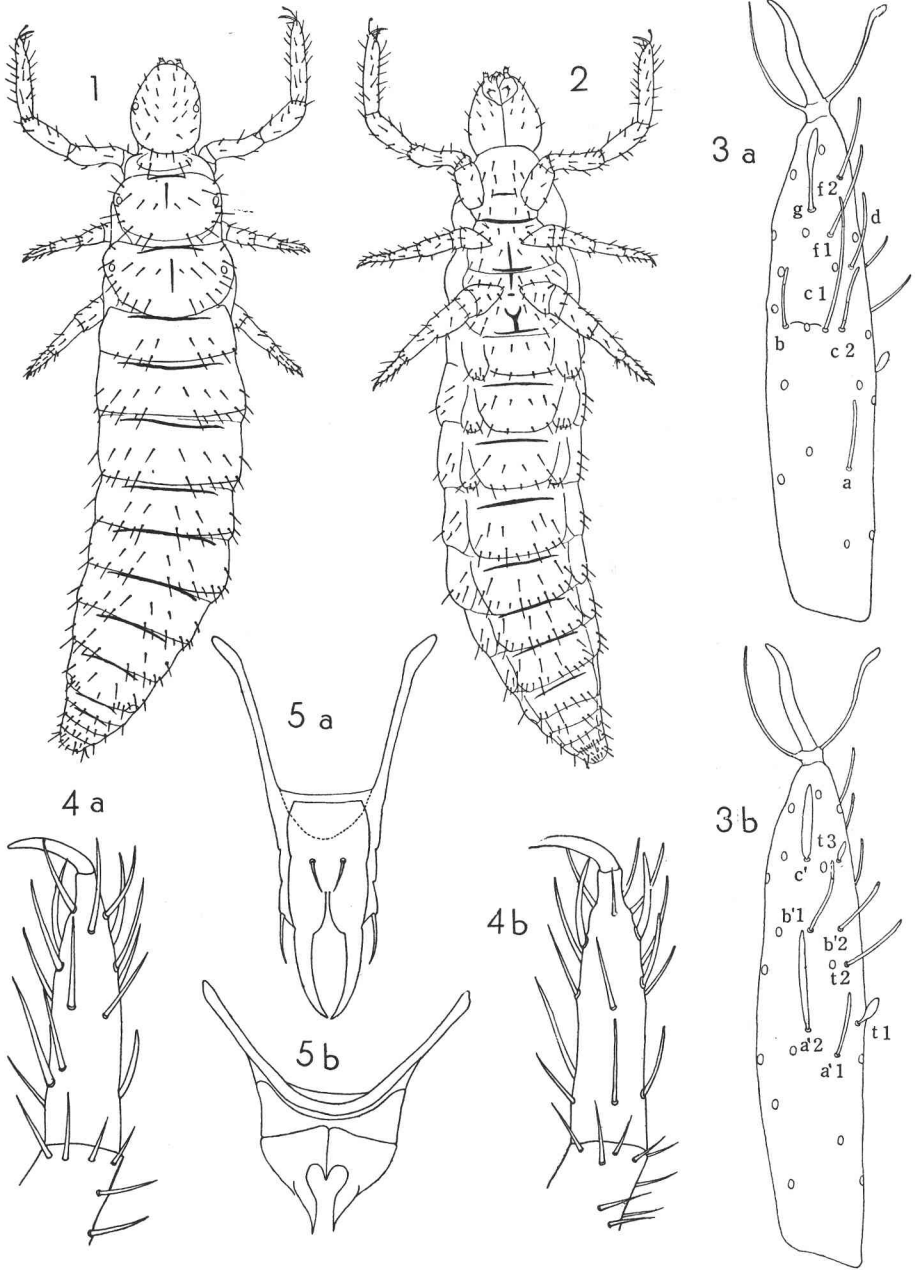


Plate II

*Eosentomon kumei* n. sp.

Fig. 6: Chaetotaxy of Abdominal segments III-VII.

Fig. 7: Female genital organ.

*Eosentomon sakura* n. sp.

Fig. 8: Chaetotaxy of abdominal segments III-VII.

Fig. 9 a-b: Foretarsus in exterior and interior view.

Fig. 10: Female genital organ.

*Eosentomon pacificum* n. sp.

Fig. 11: Chaetotaxy of abdominal segments III-VII.

Fig. 12 a-b: Foretarsus in exterior and interior view.

Fig. 13: Female genital organ.

# Plate II

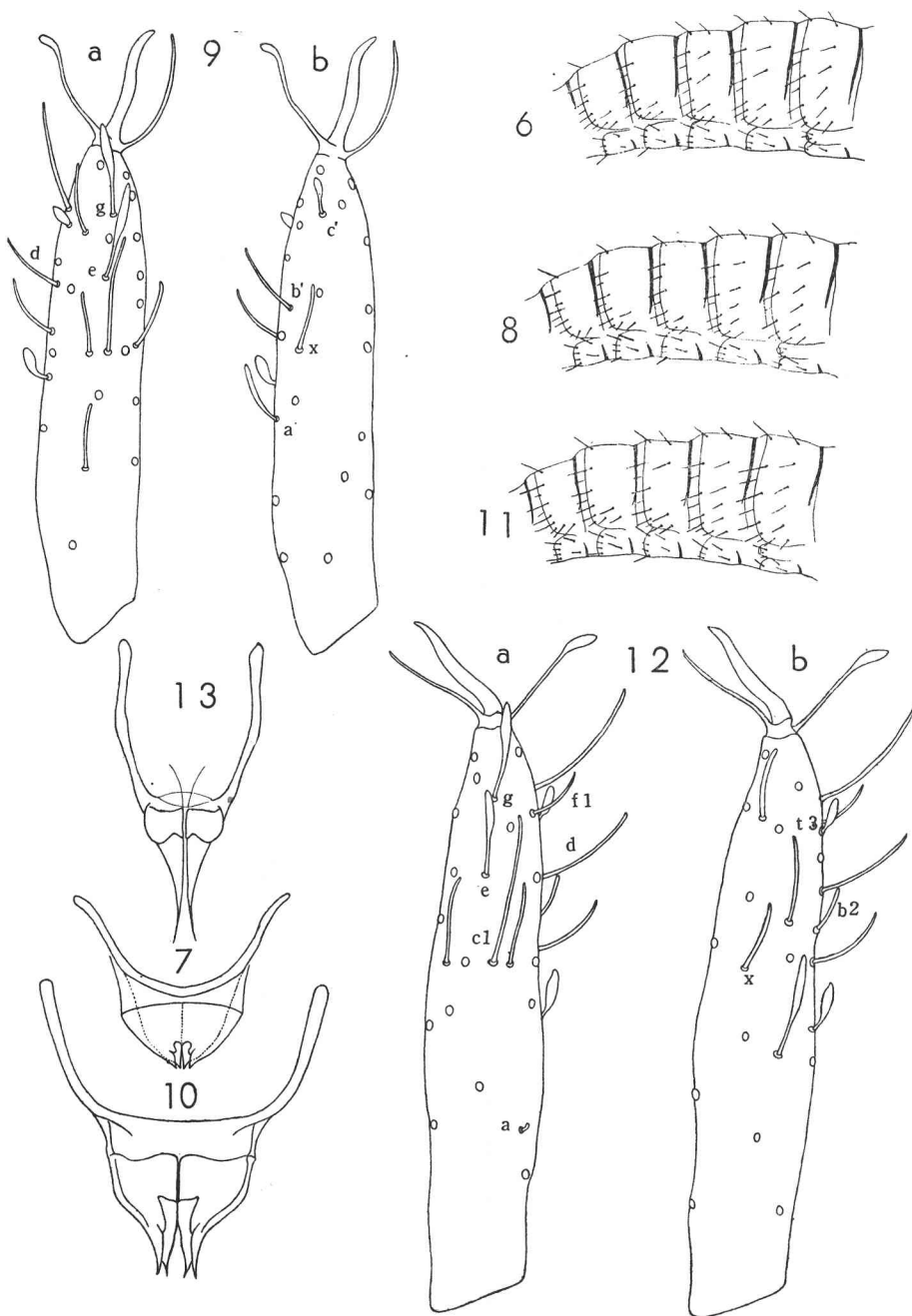




Plate III

*Acerentulus morikawai* Imadaté et Yosii

Fig. 14: Chaetotaxy of abdominal segments V-VIII.

Fig. 15: "Filamento di Sostegno."

Fig. 16 a-b: Foretarsus in exterior and interior view.

Fig. 17: Comb of abdominal tergite VIII.

Fig. 18: Male genital organ.

*Acerentulus montanus* n. sp.

Fig. 19: "Filamento di Sostegno."

Fig. 20 a-b: Foretarsus in exterior and interior view.

Fig. 21: Comb of abdominal tergite VIII.

*Acerentulus yanasei* n. sp.

Fig. 22: Chaetotaxy of abdominal segments V-VII.

Fig. 23: "Filamento di Sostegno."

Fig. 24 a-b: Foretarsus in exterior and interior view.

Fig. 25: Comb of abdominal tergite VIII.

Plate III

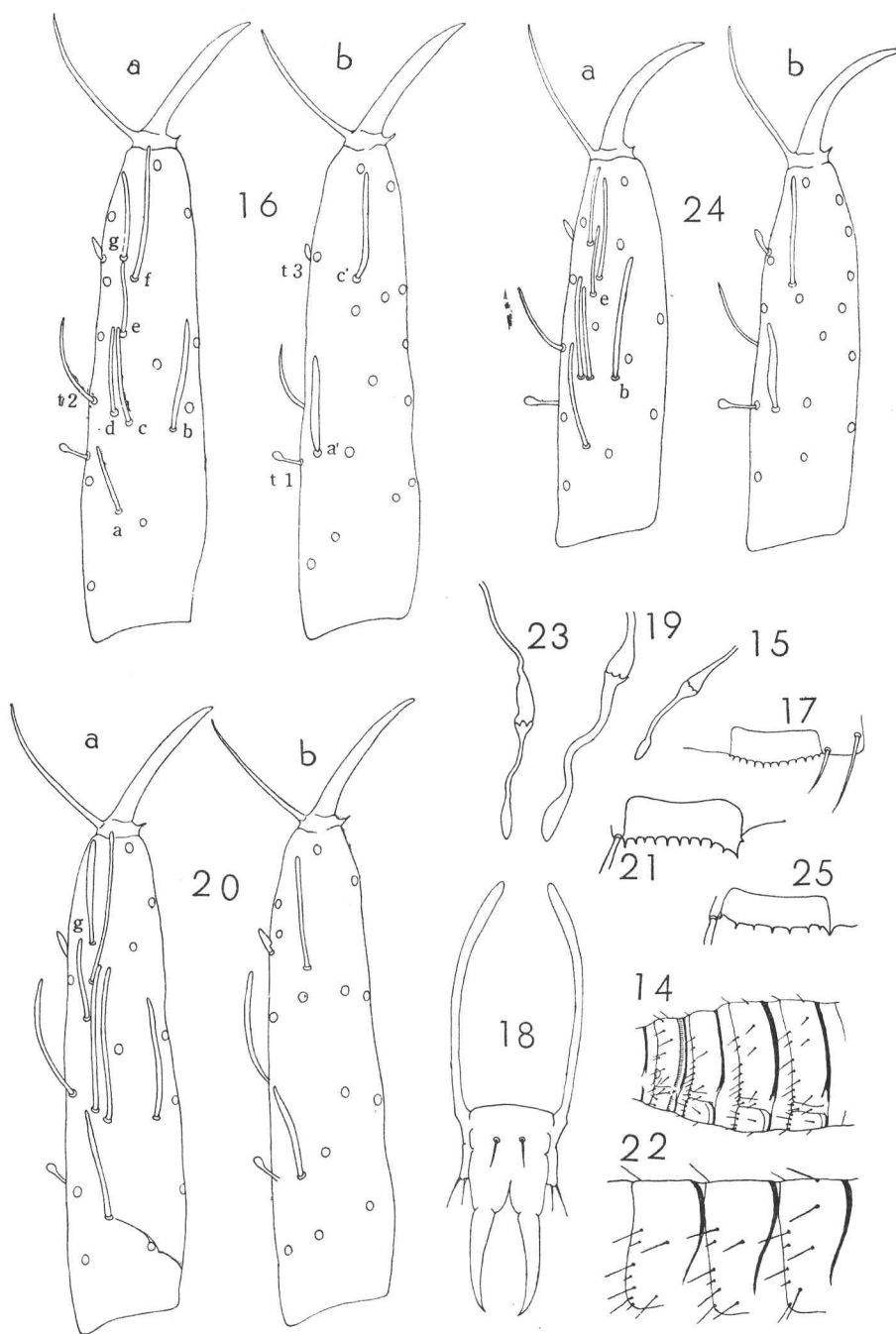


Plate IV

*Acerentulus tosanus* n. sp.

Fig. 26: Chaetotaxy of abdominal segments VI-VII.

Fig. 27 a-b: Foretarsus in exterior and interior view.

Fig. 28 a-b: "Filamento di Sostegno" and comb of abdominal tergite VIII.

*Acerentulus nitidus* n. sp.

Fig. 29: Male genital organ.

Figs. 30-31: Dorsal and ventral chaetotaxy.

Fig. 32 a-b: Foretarsus in exterior and interior view.

Fig. 33: Comb of abdominal tergite VIII.

Plate IV

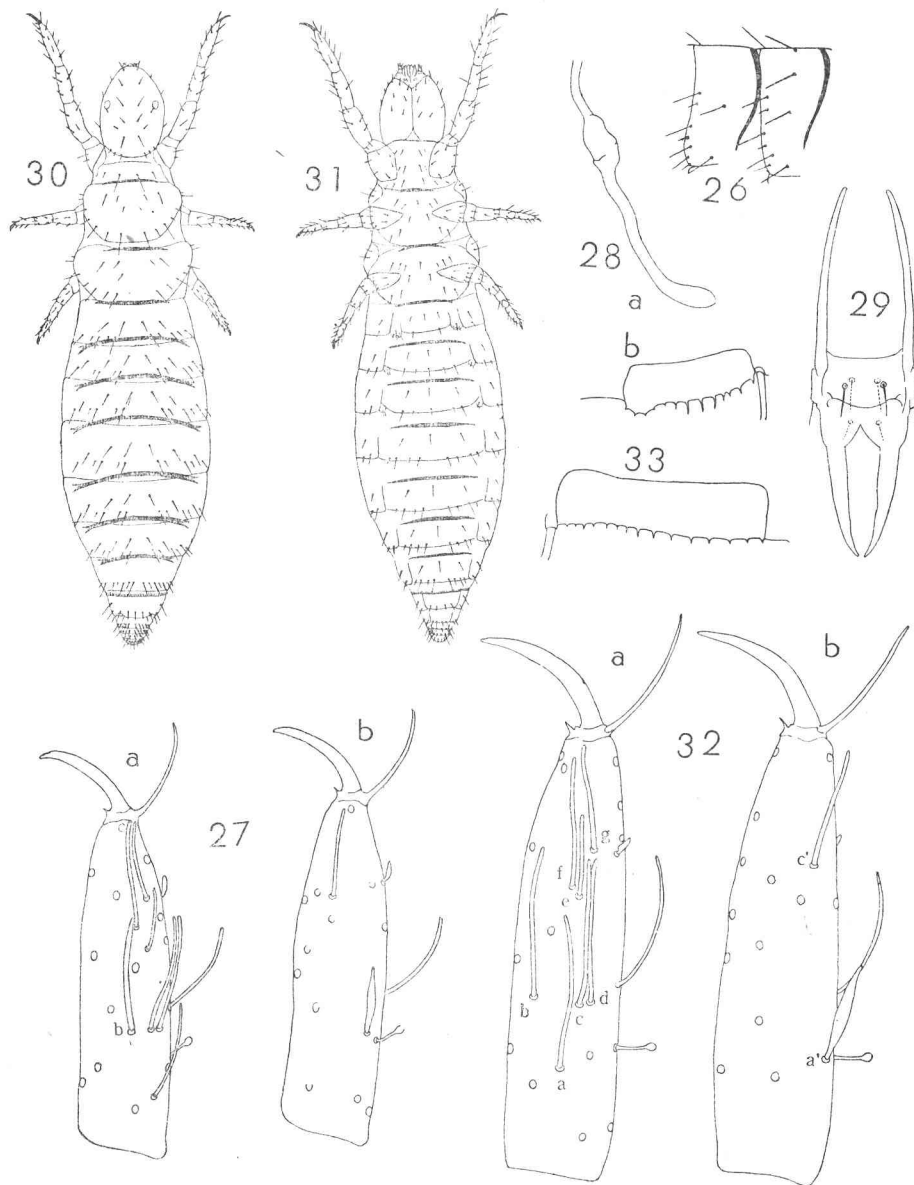


Plate V

*Nipponentomon nippon* (Yosii)

Figs. 34-35: Dorsal and ventral chaetotaxy.

Fig. 36 a-b: Maxillary palpus and "Filamento di Sostegno."

Fig. 37 a-b: Foretarsus in exterior and interior view.

Fig. 38: Comb of abdominal tergite VIII.

Fig. 39: Pectinated structures of abdominal segments IX-XI.

Figs. 40-41: Dorsal and ventral chaetotaxy of "Larva I."

Plate V

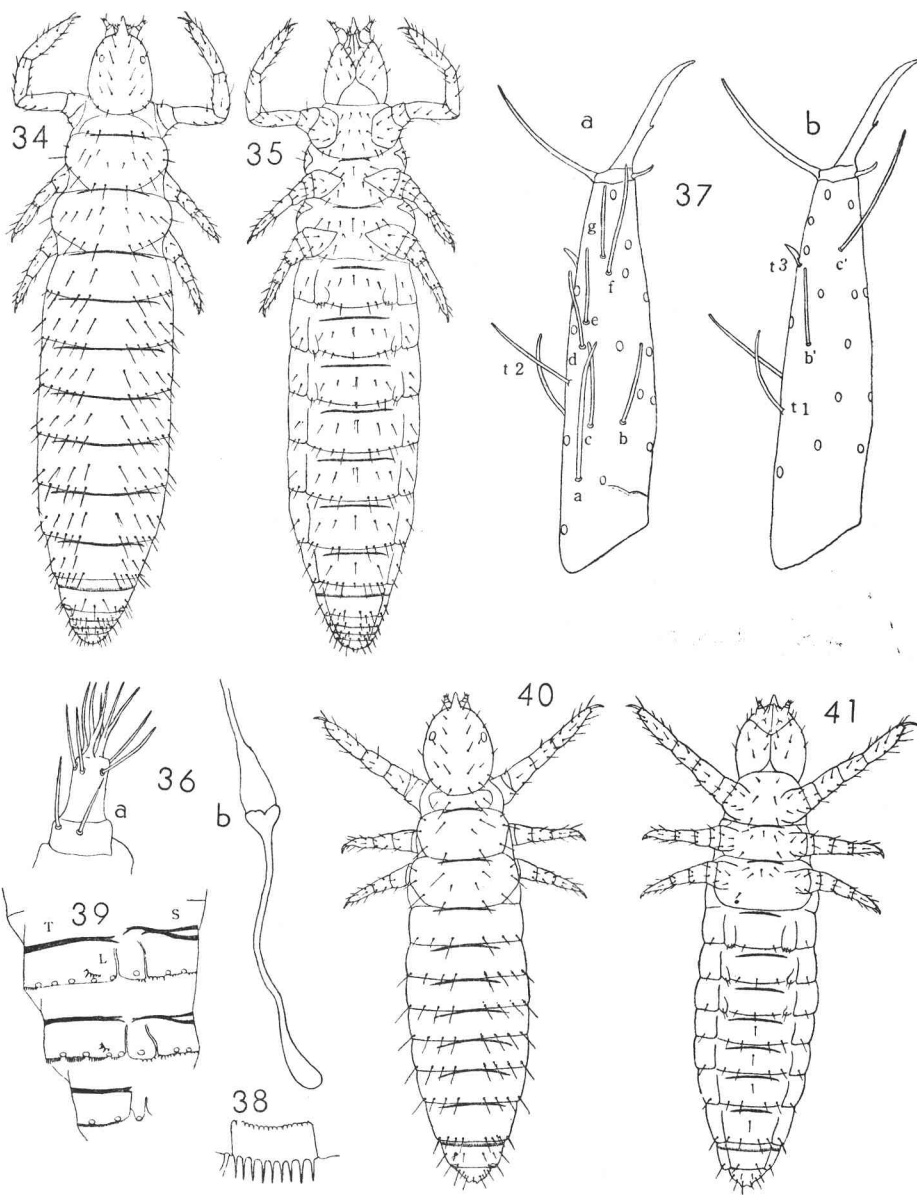


Plate VI

*Nipponentomon nippon* (Yosii)

Figs. 42—43: Dorsal and ventral chaetotaxy of "Larva II."

Figs. 44—45: Dorsal and ventral chaetotaxy of "Mature junior."

Fig. 46 a-c: Pectinated structures of "Larva II" (a-Comb of abdominal tergite VIII, b-Abdominal sternites VIII-IX, c-Abdominal tergites IX-X).

Fig. 47: "Mature junior." Pectinated structures of abdominal segments IX-X.

*Nipponentomon sawadai* (Imadaté)

Fig. 48 a-b: Foretarsus in exterior and interior view.

*Nipponentomon dimorphum* n. sp.

Fig. 49: "Filamento di Sostegno."

Fig. 50. Foretarsus in exterior view.

Fig. 51 a-b: Pectinated structure of abdominal tergite VIII (a-Male, b-Female).

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# Plate VI

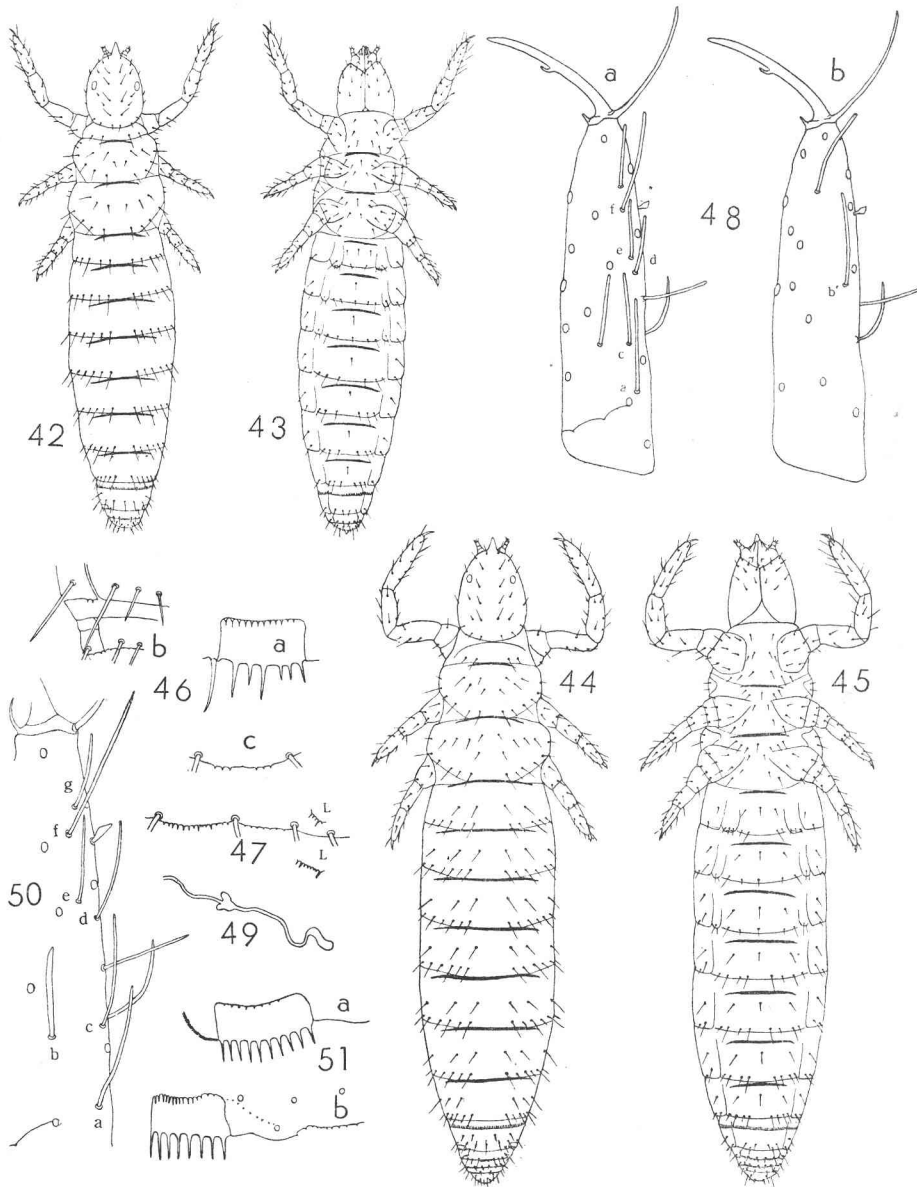




Plate VII

*Nipponentomon uenoi* n. sp.

Figs. 52-53: Dorsal and ventral chaetotaxy.

Fig. 54: "Filamento di Sostegno."

Fig. 55 a-b: a-Comb of abdominal tergite VIII, b-Pectinated structures of abdominal segments IX-XI.

Fig. 56: Pectinated structures of abdominal segments II-VI.

Fig. 57: Male genital organ.

Plate VII

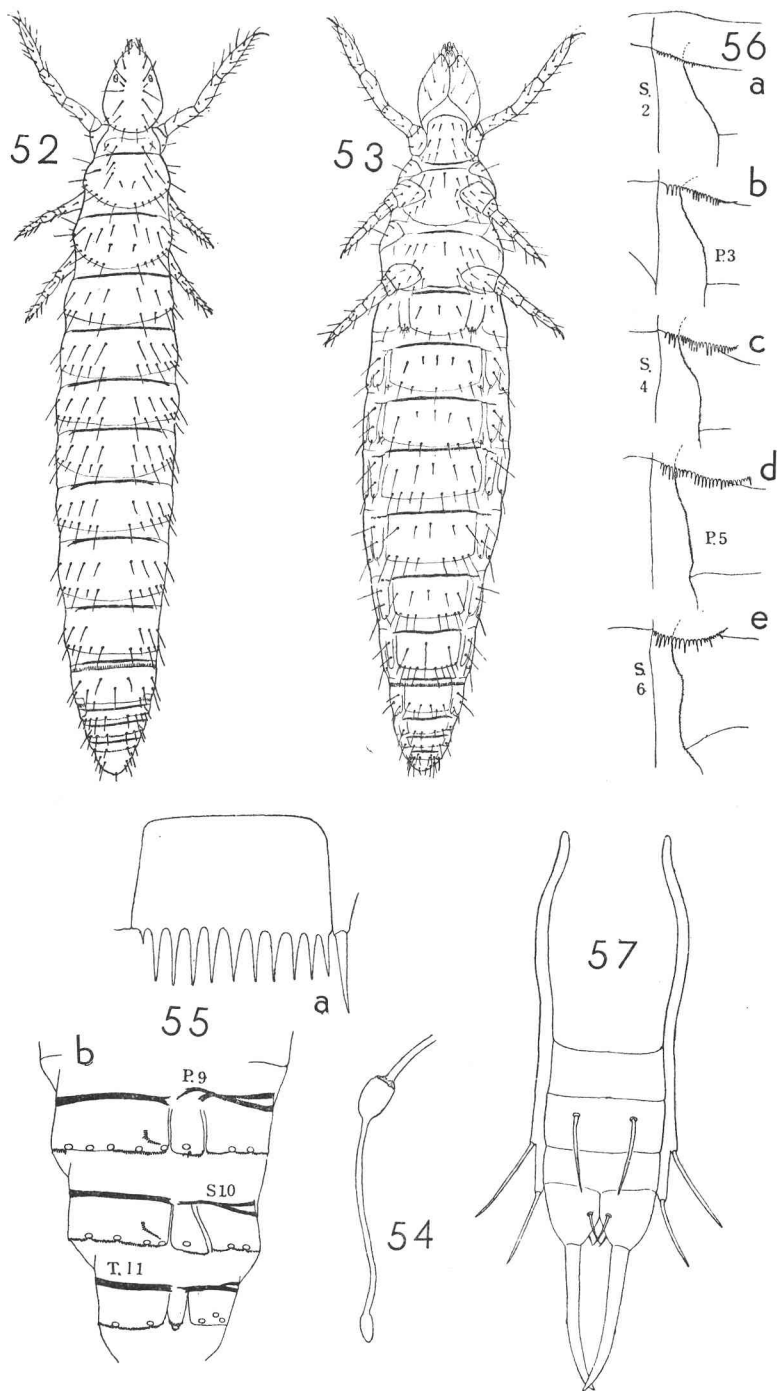


Plate VIII

*Acerentomon yamato* (Imadaté et Yosii)

Figs. 58-59: Dorsal and ventral chaetotaxy.

Fig. 60: Maxillary pulpus.

Fig. 61 a-b: Foretarsus in exterior and interior view.

Fig. 62: Comb of abdominal tergite VIII.

Fig. 63 a-b: Pectinated structures of abdominal segments  
(a-Tergite IX, b-Pleurite VIII).

*Acerentomon lubricum* (Imadaté)

Fig. 64: Chaetotaxy of abdominal tergites IV-VI.

Fig. 65: Foretarsus in dorsal view.

Fig. 66 a-c: Pectinated structures of abdominal segments  
a-Tergite VIII, b-Plurite VIII, c-Tergite IX).

*Acerentomon takanawanum* (Imadaté)

Fig. 67: Foretarsus in exterior view.

Fig. 68: Comb of abdominal tergite VIII.

Plate VIII

